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Announcement Concerning Back Numbers.

The publishers of this journal have heretofore endeavored to keep on hand indefinitely a supply of the separate numbers of back volumes. Experience shows that there is very little demand for such numbers more than a year old, while the trouble involved in keeping them is wholly out of proportion to the value of the accommodation to subscribers. It has been decided, therefore, to keep separate copies for but twelve months back of the current issue. Orders for issues prior to May, 1904, should be sent in immediately, as the stock on hand will be disposed of at an early date. Bound back volumes will, however, be kept on hand as heretofore.

The Foundations of Buildings.

A few weeks ago eight new brick buildings fell down in New York and a number more showed signs of failure. It was currently claimed that they fell because the brickwork was laid up in too cold weather, an assertion which this journal pointed out at the time was probably incorrect. The failures have been investigated carefully by Messrs. Thomas J. Brady, Otto M. Eidlitz and George A. Just, three men well acquainted with structural work and able to ascertain the cause of the collapses if anyone could do so. They report that the walls fell in each case as a result of the failure of the foundation walls. The latter were full of voids, built of irregular and undersize stone, improperly bonded and improperly bedded. The mortar was of inferior quality and poorly mixed. In fact, these walls were so poor that they could not sustain safely at any time the superposed loads. They were apparently constructed just as the builders wished, without regard to the plans filed with the department of buildings.

This journal has repeatedly pointed out the necessity of careful design and construction for foundations of every sort. Even in the foundations of buildings of a high grade, there is a tendency to skimp material and to do rough work which should never be allowed. This can be seen everywhere and is merely a manifestation of the crooked view of things which rates anything out of sight as unimportant. Such a view may be desirable in an ostrich, but it certainly is not in a man, and to prevent harm coming from it most cities have good building laws. If they were rigorously and justly enforced, such failures as those of the eight new buildings in New York could not occur. The difficulty lies in enforcing the laws. Anybody acquainted with the amount of new construction and reconstruction taking place in New York all the year through knows that the inspectors of the department of buildings are too few in number to enforce the laws. They must be assisted by some other means, and such assistance ought to be paid for by the owner of the building. This is shown by the facts in connection with the eight structures which recently tumbled down. The architect who planned them was not engaged to superintend their construction, and everything was left to the builder. The result of such a policy is well stated by Messrs. Brady, Eidlitz and Just as follows: "We can only conclude that these buildings were erected without proper supervision, under inefficient inspection and by incompetent contractors; that the provisions of the building code were generally disregarded, and that a very low standard of work is typical in this class of buildings."

The method of forcing the owner to put up good buildings remains to be found. Just what it will be is now questionable, although it will probably lie in compelling him to employ an architect and a builder who will both be responsible for complying with the building laws and may be debarred from carrying on work in the city in case they are found persistently violating these laws. This involves some form of license for both architect and builder, and will doubtless be fought tooth and nail by both classes. The architect will consider it derogatory to his professional standing to take out any kind of a license, although this is required of both doctors and lawyers before they can practice. The builders will fight such a proposal because they will fear putting themselves in the power of corrupt city officials. There can be no question, however, that a law could be easily passed without opposition from architects or builders, requiring owners to pay architects to supervise the construction of the buildings they design. This ought to be done, not only to give the architect an opportunity to compel the proper execution of his plans, but also to make him responsible for any failures that may occur through faulty plans. There are too many incompetent architects and engineers drawing up plans for structures which may cause serious loss of life in case of failure; under the present laws they are generally able to shift the responsibility for accidents to the contractors, but if they are made legally responsible with the contractors for the safety of the structures built from their plans, these plans are likely to be of a higher grade than some of them are now.

Concerning Blackmail.

It has been hinted to The Engineering Record from time to time that it would do a useful and creditable piece of work if it exposed the system of blackmail alleged to exist in some branches of a department of one of our large cities. Very likely such an undertaking would prove gratifying to a few readers who claim to be sufferers from this system. The task must be declined, however, for it is in no way within the scope of this journal's province, and cannot be done, anyway, so long as the people affected by this alleged blackmail remain as lacking in backbone as a wet towel. Such things cannot happen unless people are so timid that they fall victims to the pressure brought to bear on them for bribes and illegal tips.

An example of the condition which exists will explain the uselessness of attempting reforms without the co-operation of the people who are held up by official freebooters. The officers of a city department were morally certain that a subordinate was blackmailing dealers in certain classes of supplies. They finally learned that he had demanded $2,000 of a dealer to approve his supplies for use in the city. He said that $500 of this was for himself, $500 for the assistant chief of his department, and $1,000 for the chief. As a matter of fact, the chief and assistant chief were both honest men anxious to catch this subordinate. They accordingly told the dealer to beat the subordinate down to $1,000, which they would furnish in marked bills. A few months later they met the dealer and asked why he had not come for the bills. He replied that after thinking the matter over he had determined that it was a foolish thing to do. Long after they were out of office their blackmailing subordinates would still be in their positions and able to cause trouble. So he concluded it would be better to continue in the old way. Two more dealers, who made similar complaints and were offered the same kind of assistance, backed down for a like reason. Accordingly, the head of this particular department was unable to show up the criminal practices of his subordinate and the man is still holding office to-day, causing trouble to his superiors and milking every business sheep unfortunate enough to get into his clutches.

The remedy for this trouble is really not difficult to see. No single manufacturer can fight official corruption of this sort; but there is every reason to believe that an association of manufacturers could be formed, with good counsel to aid them, which would speedily put the blackmailers in jail and keep others from holding office long enough to make trouble. Newspapers and technical journals are not established and conducted for such work, for which an anti-blackmail association might be formed in every city where such things are frequently attempted. The expense, divided among all manufacturers liable to hold-ups, would be much smaller than the sums they say they are now paying to corrupt officials, and by fighting the blackmailers they would possess the confidence of the public, which they can hardly expect to secure by their present policy of complaining acquiescence to the demands of every official robber.

The Fremont Impact Test.

A few weeks ago there was printed in this journal a brief account of the purpose and methods of the impact tests of M. Fremont. It is not improbable that some type of shock test will be employed rather extensively in this country before long, and in order to present the matter authoritatively in this place, the following discussion was requested from the bridge engineer of the Boston & Maine R. R., who has probably devoted more attention to it than any other American engineer.

The avowed object of the shock tests made on Fremont's impact machine, described on page 350 of The Engineering Record of March 25, is to measure accurately the work necessary to produce rupture in a specimen of a given size and form, always maintaining the same speed of impact. This is no doubt an interesting line of scientific research, and it may develop valuable knowledge regarding commercial steels; but a far more valuable use of the nicked or grooved bending test, in the writer's opinion, is to ascertain whether or not ordinary structural steel is abnormally brittle from segregation, improper heat treatment, or other cause.

Many experimenters have endeavored to deduce the physical properties of steel by impact testing, by the use of delicate means of measuring the exact force expended by the hammer in producing rupture. The sources of loss, however, in deformation of the specimen and from forces radiated to the foundation and the surrounding air, are so uncertain and unmeasurable, as shown in Johnson's "Materials of Construction," that the method has never found commercial favor.

In a paper read by the writer at the 1904 meeting of the American Society for Testing Materials (published in Vol. 4 of its Proceedings), a use is shown for nick bending tests that appears to be practicable and to have a field of commercial usefulness. The object of the test therein described is to produce a break in the specimen that will show at once whether the material is ordinarily ductile or brittle. The breaking is to be done by steady pressure by means of a roller forcing the end of the specimen over as it is clamped in a vise. The specimen is nicked by a chisel, saw or milling cutter to ensure a break; and the vise and roller are operated by hydraulic pistons attached to a frame which is designed to be set up at the shipping end of a rolling mill.

It is proposed to make use of crop ends roughly sheared out. They are to be wide enough so that the action of the shear will not affect the fracture; and, as no machining is needed except to cut the groove, it is believed that the test for brittleness can be made before the plate or shape is cool enough to be shipped.

This test can be applied to rolled beams which are very likely to be rolled too hot, as well as to rails, of which we hear so much complaint lately regarding pipes and bad structure. It will expose pipes, lamination, dull cokey appearance and coarse grain. It is cheap and expeditious. If properly organized and operated it will not delay the output of the mill, and it will lead to the detection of nearly all the brittle steel that is tested.

Fremont's paper is given in full in the "Proceedings" mentioned above, as an appendix to the paper by the present writer; and, in it, are many illustrations of the actions of specimens broken by nicked bends, as well as a full explanation of the phenomenon of breaking by ductile and fragile steels. In it he shows that ordinary tension and plain bending tests do not always detect brittle steel; but that a groove, by localizing the stretch on the tension side, will cause brittle material to break without bending. He also shows that ductile material may be broken short off by a blow of sufficient velocity. This undesirable effect of impact is an argument against its use, for we do not want to condemn material that is reasonably good, and the pressure test recommended above will surely show up that which is unreasonably bad. It is hoped that this method of testing will be adopted by those who are now complaining of brittle and piped steel. J. P. Snow.

Business Engineering.

There has been received from President A. C. Humphreys, of Stevens Institute, a book bound in a modest gray cover which is one of the most gratifying signs seen in some time of the growing revolt against impractical technical education. It gives his lecture notes on some of the business features of engineering practice. It is a sound argument, indirect but no less forcible, by one of the most successful American engineers having an international practice, for the study of commercial methods by engineers. Every undergraduate in a technical school will find it helpful, for it will explain to him the importance of the financial side of his work. The lawyer does not often have to fashion his advice to a client by any other rules than those of the law. The physician needs no bookkeeping to help him make a diagnosis nor any high finance to prescribe a remedy. The clergyman is concerned with other subjects. But the professional work of the engineer from beginning to end involves a consideration of costs as well as the laws of nature, and it is only false pride that keeps him from openly acknowledging in his schools and his societies that the business side of his work is of great importance.

It is this lack of appreciation of the importance of commercial methods that has kept engineers in the back row so many years. The wails about lack of appreciation of engineering talent reveal only a failure to grasp the spirit of the times; they accomplish no good, and they merely amuse the men who are doing things. Any man who thinks that a goodly store of technical data is all that is needed to make him a successful engineer has a serious jolt in store for his self-esteem. Technical information is necessary for success, but so is ability to use that information effectively and to make other people know where to go for technical advice. In order to convince capitalists and official boards of the importance of his recommendations, the engineer must come down from the rarified atmosphere of his scientific workshop and talk to these people in a way they can understand. He must use their language, and that is the language of business. Unless he learns it thoroughly, he will never be very successful; he will fritter away his abilities against the barrier of commercial surroundings, and will waste the gifts he ought to employ for useful ends.

A few centuries ago, when a man desired anything he took a large hammer, hunted up somebody who had what he wished, and pounded the fellow until he could take it away. It was the customary method of the period, and we enjoy reading about it in historical novels. Nowadays, the same man, were he living, would take a very small hammer and tap here and there on the reputation of the people he wished to do business with. He would loosen a rivet here and a seam there until finally he could tear aside the defending reputation, credit, affiliations—call it what you will—and take what he wanted. He could do this because he was acquainted with the business methods of the times. For many years the engineers have had the good things of life taken from them in this way, because they did not know how to prevent it. They called themselves professional men, and so let any third-rate promoter or grasping directorate take the best work of their lives for little or nothing. It was their fault, but it was no less painful.

President Humphreys has very wisely determined that a technical school which does not tell its undergraduates how to do business safely with business men is not fulfilling its obligations to them. The mental nakedness of some of the young men from these schools is disgraceful. They have an exaggerated idea of the value of their ability, do inaccurate work in a few advanced branches of engineering, and have no idea at all of the many things they must learn to be of real use in the world. This defect is due to their distorted perspective of their future work. The money side of it, and all that pertains to it, they do not understand; and so they are not only unable to help others, but they are also defenseless against others. The Engineering Record expects to see important improvements result from the attempt at Stevens Institute to remedy this condition, and believes that its Department of Business Engineering is an innovation in technical education which will have a most beneficial influence on the profession.

The Terminal Facilities of the City of New York.

The terminal facilities of a great shipping port like New York must meet complex requirements in these days of intense competition if the growth of the port is to be maintained. Terminal charges must be reasonably low, and the facilities for transshipment from land to ocean carriers must be convenient and rapid, even when the "differentials" are arranged to operate favorably to the trade of the port. Those conditions of the business of the port of New York which affect its prosperity have for many years been the subject of much consideration in all their phases, especially in connection with the long discussion leading up to the adoption of the project for substantially improving the canals of the State. The diversion of business from the port of New York for other reasons, if there are any, than railroad differentials is usually ascribed to the influence of certain elements of the terminal facilities involving terminal charges in one shape or another. It has been stated many times that shipments to and out of the port of New York have at least relatively decreased and that it is, consequently, fast losing its primacy and, again, that if something is not soon done to relieve the situation, this progressive retrogression will be hopelessly beyond remedial control. Yet the annual enhancement of the city's prosperity is unprecedented, and there is an increasing aggregate of shipments by water.

The natural conditions of the harbor of New York are all conducive to the growth of a great port. There is an almost unlimited amount of deep water practically land-locked, with a range of tide so small that the most inexpensive type of pier or wharf may be employed to serve efficiently all classes of ships. Costly masonry quays and closed docks, such as the high range of tides in many foreign ports renders indispensable, are wholly unnecessary here. This means much more than at first sight appears. Where plans for elaborate and costly waterfront facilities must be developed, they naturally, even necessarily, provide efficient accommodation for both receiving and shipping freight as well as the most convenient and economical transshipment of all classes of goods. This is the logical result of a careful study of all the elements of the terminal problem under such conditions. In other words, the conversion of adverse natural features to efficient terminal purposes compels the recognition of and the most economical provision for all elements of the terminal business involved.

In the port of New York, as in all American ports, the favoring condition of nature has made it comparatively easy for either railroads or ships to reach almost any point in any harbor, and in the former the deep waters about Manhattan Island and the development of business on it have practically forced apart the points of delivery of railroad freight and those of receipt of ocean-going ships. This separation of points of delivery and actual shipment has made necessary superfluous terminal handling by various methods, with enhanced terminal charges, and has done much, if not all, to arouse the critical discussion of terminal conditions in the port of New York which has extended over many years. These conditions, again, constitute the marked difference in terminal characteristics between the port of New York and other Atlantic coast ports, the latter easily affording a combination of points of railroad delivery and loading of ships. The only real advantage of other ports over that of New York, so far as terminal facilities are concerned, is found in this one feature. Whenever the terminal arrangements at New York become so far changed that the lost motion, so to speak, between the railroad train and the ocean steamship is cured, there will be little left to be desired to make its competition with other ports successful. On the other hand, there is little reason to expect that it will be able to escape the handicap of superfluous handling and relatively high terminal charges until those ends are attained.

A large part of the marine business of New York is coastwise in character, showing that a substantial portion of railroad deliveries at New York terminals finds its way out of the harbor in coasting ships. The general observations just made regarding ocean shipments apply probably with added force to coastwise business, because it is of a more scattered character and the advantages of handling in large masses is lost to it. Viewed, therefore, as to either domestic or foreign shipments, the gain to the port of New York by improved terminal facilities will be most substantial.

The new 2,000,000-bushel fireproof grain elevator at Weehawken, N. J., for the New York Central & Hudson River R. R., described in The Engineering Record last week, is conclusive evidence that the management of that company believes in the improvement of its terminal provisions for handling grain. The accommodations of the New York Central company for transshipping cargo from cars to vessels on both sides of the river at New York are now greatly extended in the right direction, the elevator capacity on the New York side being 1,500,000 bushels, and at Weehawken 2,200,000 bushels. Cars and ships are practically placed alongside of each other with nothing between but the most efficient and economical handling machinery. All use of floating elevators and car floats is completely avoided, with a corresponding reduction of fixed and operating charges.

Other railroads terminating on the New Jersey side of the river have made similar developments for accommodating ocean shipments, although to a more limited extent. These movements indicate what will probably be the location of the great bulk of future transatlantic shipments, if not a goodly portion of those destined for coast points, viz., the New Jersey water front, although the Brooklyn front will undoubtedly attract to itself a large shipping business of somewhat different character. The large business of the improved Erie Canal when completed may possibly be a factor to be reckoned with in the future, but it is not at all likely that the trend of waterfront development to meet the requirements of bulky ocean freights will be materially changed by canal influences.

The necessity of delivering railroad cargo practically alongside of the ships destined to receive it was clearly and forcibly indicated by the board of consulting engineers who acted for the Department of Docks a half-dozen years ago, and such developments of terminal facilities as those just created by the New York Central Co. at Weehawken show conclusively that the principles they advocated are correct.

Municipal Street Railways in Chicago.

The people of Chicago have expressed a very strong desire for the direct municipal control of street railways by recently electing, by a decisive vote, for their mayor a gentleman who is stated to have prepared the following epitaph for his tombstone: "He died a poor man, but he was the father of municipal ownership and thirteen children." It cannot be denied that he has preached the civic control of street railways from the Levee to Michigan Avenue, and has refused to be beguiled into discussing any other issue. His insistence on the improvement of local transportation in Chicago, which most people agree is susceptible of betterment, has put him in office to accomplish a task full of complication and opportunities for failure. How well he will succeed remains to be seen, but in a general way his program seems to be a sensible one.

The most complete study of local transportation in Chicago was made by Mr. B. J. Arnold in 1902, and his recommendations for improvements are understood to be generally acceptable to both the citizens and the street railway companies. They have been accepted by the new city administration, and there will thus be no long waiting for a working project. Just why the manager of the Glasgow tramways has been engaged to give advice to the city on the subject is not apparent in view of Mr. Arnold's connection with the work; but the action was doubtless due to the same feeling that recently led the federal authorities to decide upon an international advisory board of engineers in connection with the Panama canal.

At the present time there is a suit before the Illinois courts to determine the status of the right to use tracks in certain Chicago streets. It is considered probable that the claim of the local company to a franchise for these trackage rights will be declared void of legality. Acting on this assumption the city authorities have already called for bids for building a first-class electric railway system on these streets. The first installation of the municipal railway will be on Adams, Desplaines and Harrison Sts., Western Ave. and 12th St., with extensions on Halsted St. to the river and on Ogden Ave. to 40th Ave. As the franchises for other streets expire, the system will be extended over them if it seems desirable. Separate bids are requested for the track, rolling stock and power plant, and under the head of track bids for both overhead and conduit electric systems are requested. The bidders are also permitted to tender for leasing the system for operation by their own men, or for turning over the property to the city for municipal operation.

The plan is thus a comprehensive one, but it is not unlikely that its generality is largely due to a desire to secure bids on all practicable methods of obtaining a good transportation system. The Chicago authorities are apparently striving to obtain a really good street railway with moderate fares, and are desirous of receiving any reasonable proposition that will promise to give this result. It is not unlikely, however, that the adopted system will be like that of the subway lines in New York and the surface lines in many foreign cities. The construction will be done from the plans and under the supervision of the city's engineers, while the completed road will be leased under rigorous conditions to an operating company. Municipal ownership of this type has proved successful elsewhere, and it is more suited to American conditions than the actual operation of street railways by city employees.

Notes and Comments.

FORCED DRAFT PRESSURES are often too high, and to this cause may be attributed most of the complaints about burned grates, injured boilers and the escape of gas and smoke from fire doors. As a rule ¾ to 1¼ in. is an ample pressure in the ashpit, yet 5 in. or more is sometimes used. This is generally due to the selection of a fan too small for its work; in order to secure the desired volume of air, the fan is run above its proper speed, thus producing the excessive pressure.

A STANDPIPE ACCIDENT of an unusual character is reported from El Dorado, Kan., by Mr. J. H. Austin, city engineer. This standpipe was 12 ft. in diameter and 145 ft. high. On March 27 the city was struck by a cyclone, which blew over the standpipe and wrecked many buildings. About 90 ft. of the lower part of the pipe lies practically intact, but the upper part is torn apart at the joints, and in some places in the plates. The water-works are now being operated as a direct-pressure system, no other injury than the destruction of the standpipe having been experienced.

WATER WASTE IN WASHINGTON during January and February was so great that on several occasions the draft on the system was considerably in excess of the capacity of the purification works now under construction. This subject has been discussed frequently in Washington, but up to the present time no good method of preventing waste has been authorized. Just at present the situation is not particularly serious, but when the filters are in operation it may be questioned whether the waste of filtered water will not prove such costly carelessness that meters will be installed in large numbers to prevent it.

THE CEMENT OUTPUT in the United States in 1904 is reported by the Geological Survey as follows: The total production of Portland, natural-rock, and slag or puzzolan cements in 1904 was 31,675,257 barrels, valued at $26,031,920. These figures show a marked falling off in price when compared with prices for 1903. The production for 1903 amounted to 29,899,140 barrels of hydraulic cement, valued at $31,931,341. In the production for 1904 there is a gain of 1,776,117 barrels over that for 1903, but in the value of the cement produced there is a loss of $5,899,421. Of the total amount of cement manufactured in the United States in 1904, 26,505,881 barrels were Portland cement, valued at $23,355,119; 4,866,331 barrels were natural-rock cement, worth $2,450,150; and 305,045 barrels were slag or puzzolan cement, with a value of $226,651.

THE USE OF COPPER SULPHATE as an algicide and disinfectant in water supplies has been tried practically under so many conditions that definite data regarding it are gradually becoming available. The conclusions drawn from the experience to date by Dr. George T. Moore, who first suggested this procedure, are as follows: Much less copper is required to eradicate algae from reservoirs than is necessary to destroy them under laboratory conditions. The effect of the sulphate on fish is of considerable importance and requires more study. The physical and chemical constitution of a water are factors to be considered in determining the quantity of sulphate to use. The elimination of organisms causing pollution sometimes makes possible the development of other species, but so far the latter have never been the cause of complaint. As a result of the sudden destruction of great numbers of algae, there is sometimes an increase in the odor and taste of the water for a few days immediately after its treatment with copper or sulphate. Under certain conditions the sulphate may be used to great advantage in connection with filtration.

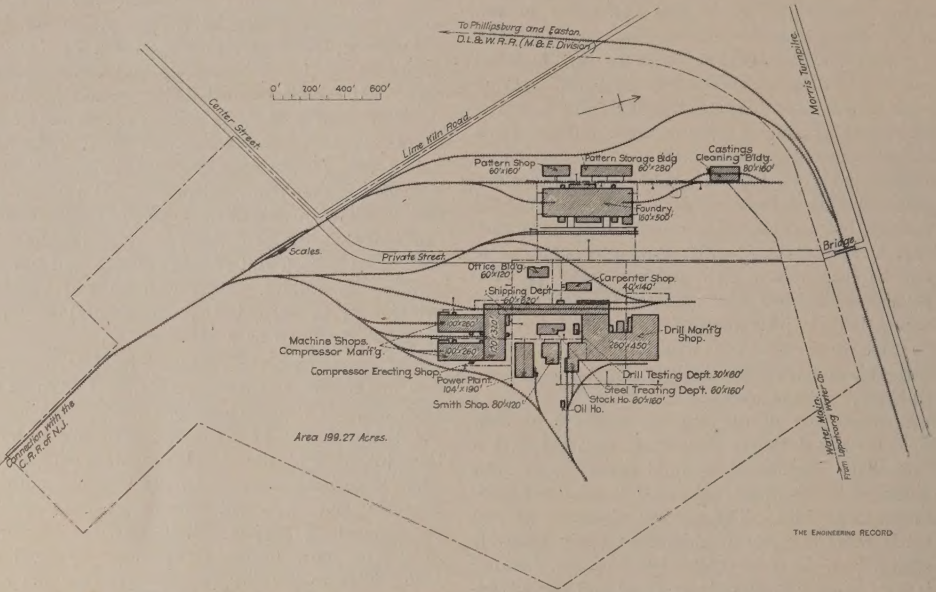
THE NEW WORKS OF THE INGERSOLL-SERGEANT DRILL COMPANY.—I.

Description of Extensive Shops at Phillipsburg for Making Air Compressors, Rock Drills, and Coal Cutters.

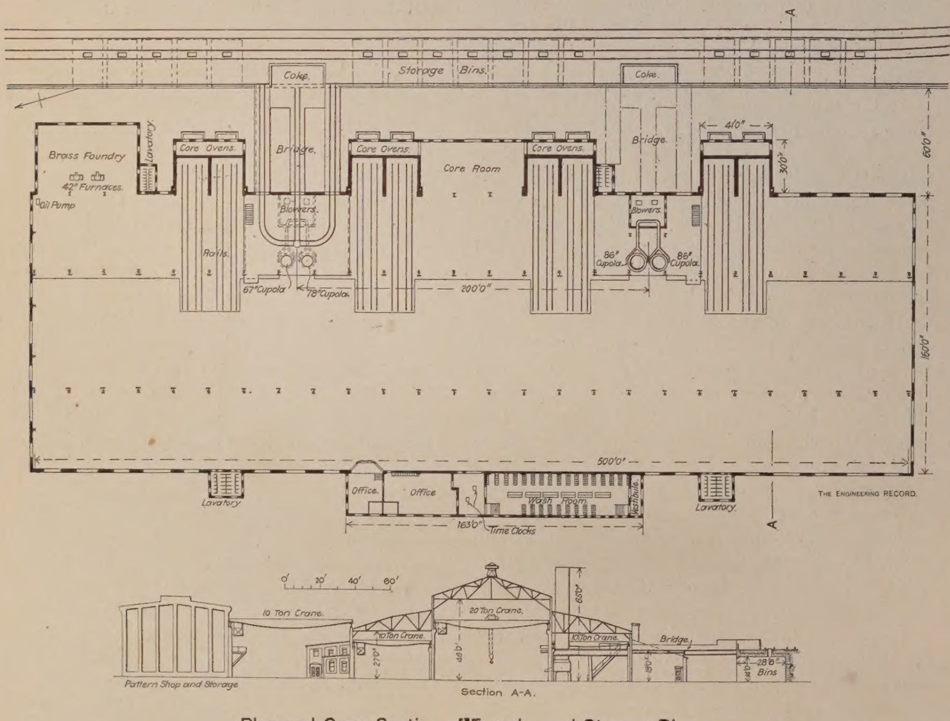
The new manufacturing plant of the Ingersoll-Sergeant Drill Co., which is now nearing completion at Phillipsburg, N. J., is of much interest on account of its novel features in both arrangement and construction of buildings and methods of factory operation provided for. An opportunity was afforded for the adoption of the most approved and efficient methods of construction and operation. The latest and best ideas were selected from modern shop practice, and many departures from the old methods of more than usual importance have been made.

The history of the Ingersoll-Sergeant Drill Co. has been an interesting one. Beginning originally with the manufacture of pneumatic rock drills, the business grew to include the manufacture of air compressors for the supply of the compressed air, and the latter branch of the company has developed to a remarkable extent in the past few years, having grown to include compound-Corliss-engine-driven two-stage compressors in the largest sizes. The manufacture of pneumatic hammers, drills and tools of other classes has also, within the past two or three years, grown to large proportions, and now forms a large and important department of the company. The rapid progress of the company caused such extensive encroachments upon the limited space available at the Easton works, that the old plant became literally outgrown, and a new site became imperative for efficient manufacturing operations. In addition to the limited space available at Easton there was troublesome overflowing of the Lehigh River. The site selected as most suitable was found in Phillipsburg, directly across the Delaware River from Easton. Here about 200 acres were available on a highland, where unlimited possibilities for expansion and good facilities for factory construction were afforded.

The new site is an irregularly-shaped tract, 1½ miles east of the center of Phillipsburg. It is at present inconvenient of access, but this will be remedied when a trolley line, now building, is completed to the works. Street connections to the city are also being laid out, and there are two railroad connections.



Plan of the Phillipsburg Works of the Ingersoll-Sergeant Drill Company.



Plan and Cross-Section of Foundry and Storage Bins.

The high general level of the tract above the normal stage of the river (202 ft.) ensures good drainage, yet it is not hilly enough to cause inconvenience. The advantages of the city water supply were unavailable, however, and it was necessary to sink a deep driven well at the power plant and put in an auxiliary supply by purchasing water rights at a dam upon a river several miles distant.

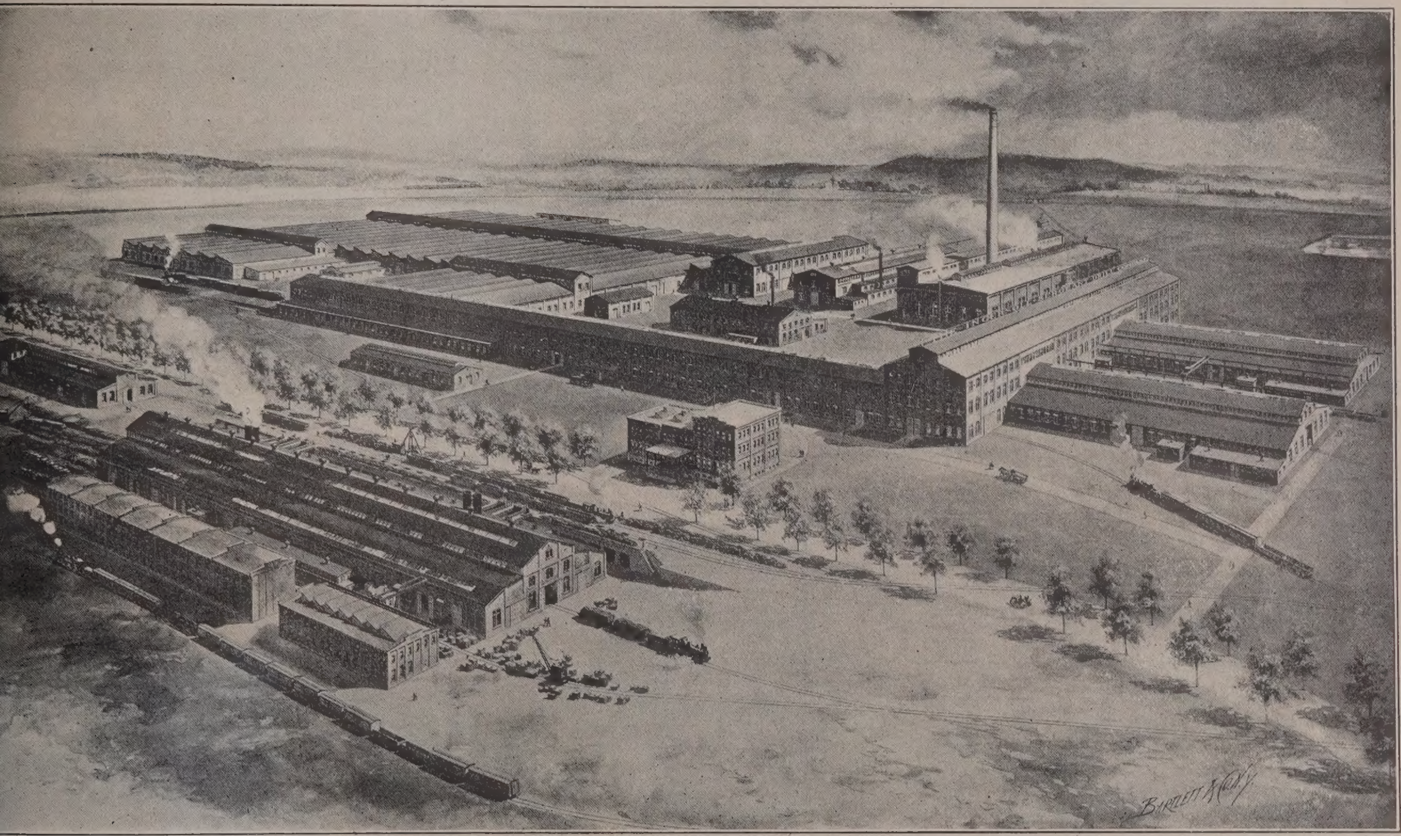
This dam, which is in the hills, 4½ miles from the shops, forms a natural basin of 31,000,000 gal. capacity, and from it water is carried through a 10-in. pipe, about 1¼ miles to a 2,000,000-gal. distributing reservoir, which supplies the plant directly through a 16-in. main; the reservoir not only provides an extra supply of water in case of possible accident to the main reservoir or dam, but also cuts down the effective pressure at the works to about 100 lb. For the control and operation of this system, a sub-company was organized under the name of the Lopatcong Water Co. A concrete dam, 25 ft. high and over 2,000 ft. long, was built at the river. The minimum flow in the river is upwards of 4,000,000 gal. per 24 hours, so that an abundant supply will be available. The quality of the water is very good for boiler purposes. The boilers run for several months before enough scale and sludge accumulates to make washing out necessary.

General Layout.—The arrangement of buildings and track connections in the plant is the result of a careful study of the requirements of the work, not only as to the interchange of parts, materials, supplies, etc., between the various departments, but also for future development. The office and shipping department are in approximately the center of the site, with the manufacturing departments adjoining. The rock drill department is connected with the shipping department at the north end, while the latter, a building 620 ft. long, joins the air compressor erecting shop at the south end. In this way the two important departments at the new plant are brought into the closest proximity to the outgoing departments. The arrangement of the pneumatic tool department has yet to be determined, as this department has not yet been removed from the old plant at Easton.

An elaborate system of track connections has been installed for interchange of supplies, etc., between the various buildings. Connections are made with all of the more important buildings, the tracks running inside for crane handling in many cases. The entire system comprises between 4 and 5 miles of track, all of which, together with a 30-ton Baldwin shifting locomotive and several cars, are the property of the company. Several of the larger buildings also have narrow-gauge industrial railways.

Buildings.—The buildings are all of steel and concrete construction with the exception of the pattern shop and storage, and the carpenter shop, which are of mill construction. The latter, as well as also the shipping department, are protected by wet sprinkler systems against fire. In the other buildings the use of wood has been minated to as great an extent as possible. The ofs are of reinforced concrete construction, th felt and slag covering, and all partitions for ice or other purposes, are of concrete block nstruction. All floors are of concrete.

Special attention was paid to securing good ht and ventilation. This result has been fav- ed by the use of the electrical system of power tribution, and the consequent absence in gen- l of long lines of overhead shafting. This ture also permitted the separation of build- gs necessary to provide adequate lighting space tween, and altogether the result has been very sirable. An example is to be seen in the in- ior view of the compressor-erecting shop. Not ly have large window areas and monitor side d skylights been provided, but also the interiors all walls, partitions, etc., and all steel frame- rk have been painted white, which, in connec- n with the general use of ribbed glass, gives most satisfactory diffused lighting effect.



General View of the New Works of the Ingersoll-Sergeant Drill Company, at Phillipsburg, N. J.

Rock Drill Department.—The rock drill man- cturing department was the first section of plant completed. The building is a single- ry structure of irregular shape, with about 0x475 ft. of floor area. The structure is of saw-tooth type, with bays 25 ft. in width be- een centers of posts, while the roof trusses are ft. apart. The clear heights under lower rds of the trusses are, in the machine bays, 13 6 in., and in the assembling bays, where jib d hand-traveling cranes are used, 16 ft. 6 in. the latter, the additional height is obtained rely by the use of lighter roof trusses, so as to raise the roof line, this being possible by absence of line shafting.

An interesting type of window construction is ed in the saw-tooth roof, as indicated in the ail drawing of the construction of this shop ilding. The window frame is of metal, and bolted within an angle framework; the fram- for the window extends downward over the ge of the angle frame in such a way as to shed ter into a gutter. Water-tightness at the edge of the window is secured by means of a copper coping and flashing, which extends over the ridge and down so as to drain the water onto the glass proper. The roofing material is of reinforced concrete, weighing about 25 lb. per square foot of exposed area. The roof is drained at frequent intervals in the hollows by 6-in. cast-iron leaders, which connect through flashings as indicated.

An interesting feature of this shop is the arrangement of the motors and the line shaft drives, which is also illustrated in the detail view of the saw-tooth construction. The motor and the main-line shaft, extending longitudinally through each saw-tooth bay, are carried on the chords of the trusses, while from the main line shaft two countershafts are driven, one over each side of the bay.

Compressor Shops.—The compressor erecting shop is 320 ft. long, with a clear height under roof trusses of 44 ft. Adjoining and connecting with this building are two compressor manufacturing buildings on the south side, and the shipping department on the northwest corner, while along the north side there is a 40-ft. lean-to extending the entire length. In the main bay it was desired to have sufficient head room to permit testing out of the largest sizes of compressors built by the company. The 44 ft. permits running the traveling crane over erected engines under test with plenty of clearance. Excellent lighting is provided not only from the side windows, but also the monitors. The latter are equipped with flat skylights of ribbed glass, which are underhung with wire guards to catch falling glass.

An interesting feature of this shop is the arrangement of the crane runways from the compressor manufacturing department and the shipping department, which are carried for some distance into the main shop, so that parts may be handled from the crane in one of the auxiliary buildings onto the floor of the main shop beneath the large crane. This permits of the handling of heavy pieces throughout all sections of the shop entirely by cranes, thus obviating the necessity of any trucking or manual handling. This feature, while not entirely new, is a source of economy in erecting operations.

The compressor manufacturing department buildings are both of the single-story type, with lean-to bays upon each side. The large center bay is in each case about 40 ft. wide, having a clear height of 29 ft. under the roof trusses, while the side bays are 25 ft. wide each, with a clear height of 14 ft.

Blacksmith Shop.—The blacksmith shop is designed for a very complete equipment. A noticeable feature is the provision for turning out forgings, which are used to a large extent in the manufacture of rock drills. Provision is also made for the handling of heavy work, as may be noted in the five steam hammers varying in capacity from 800 up to 2,500 lb. The floor in the vicinity of the hammers is commanded by jib cranes for the handling of heavy forgings to and from the fires, while the transportation of parts will be facilitated by a narrow-gauge track leading out to the other departments. It will be noticed that this track is located so as to pass under the jib crane, which facilitates the loading of heavy forgings for transportation to other departments.

The arrangement for the heating of large work is novel, and the waste gases from the heating furnaces are used in a boiler, elevated above the furnaces to receive the hot exhaust gases from them directly, the boiler in turn supplying steam for the steam hammers. Upon the opposite side of the shop a double system of blast and exhaust pipes is provided for the small fires. These fires are conveniently located for both drop hammers and forging presses as indicated.

Tempering Department.—An interesting feature of this plant is the steel treating and tempering department, which occupies one of the buildings between the power plant and the shipping department. This is a 60x140-ft. fireproof structure, equipped with annealing and heating furnaces and oil baths. Five large furnaces are installed on one side, while the oil and other cooling baths are in the center of the room. A novelty is the arrangement of a coal bunker at one side, into which coal is dumped from narrow-gauge cars on an elevated track. The doors in the bunker open toward the furnaces.

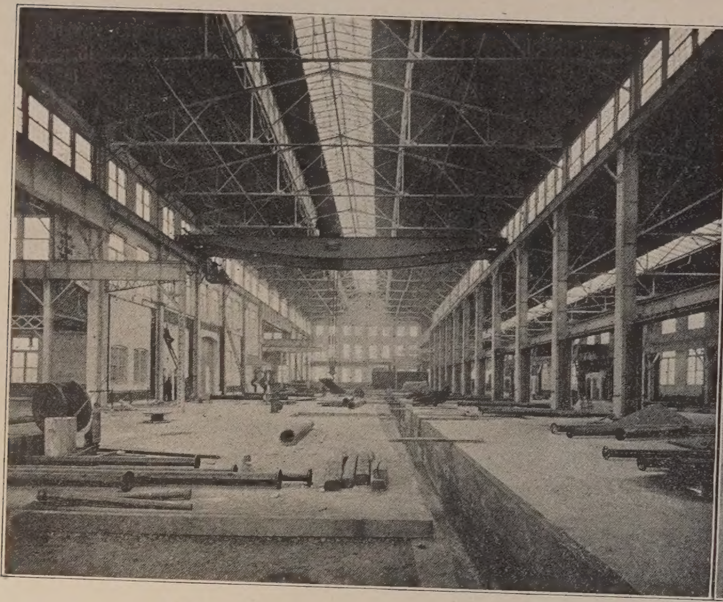
Testing Building.—Near the drill shop there is a 26x57-ft. building for testing rock drills and coal cutters. After assembling, every drill is mounted over one of the iron anvils, as shown in an accompanying illustration, for which purpose a traveling air-hoist is provided. The mounting used is a metal tripod similar to the standard tripods. The test consists of operating the drills as in regular service, with the exception that a blunt drill pad is used, which pounds on the metal anvils. This subjects them to regular operating conditions, and permits the final adjustment of the valves to be made to a nicety.

All the testing out of rock drills, of either the standard vertical type or the horizontal undercutting type, is carried out in this building, the main drill manufacturing department being concerned merely in the production, in large quantities, of all the parts, and the final assembling. This removes the excessive jarring and pounding from the main shop, although the effect of this is here reduced to a minimum by a special construction for the anvil foundations which tends to soften the jarring effect upon surrounding objects. When a constructional departure is made, or a new type of drill, such as the new "Little Jap" drill, is produced, it is tested for many months under actual operating conditions in a quarry which the company owns and maintains for this purpose in Easton.

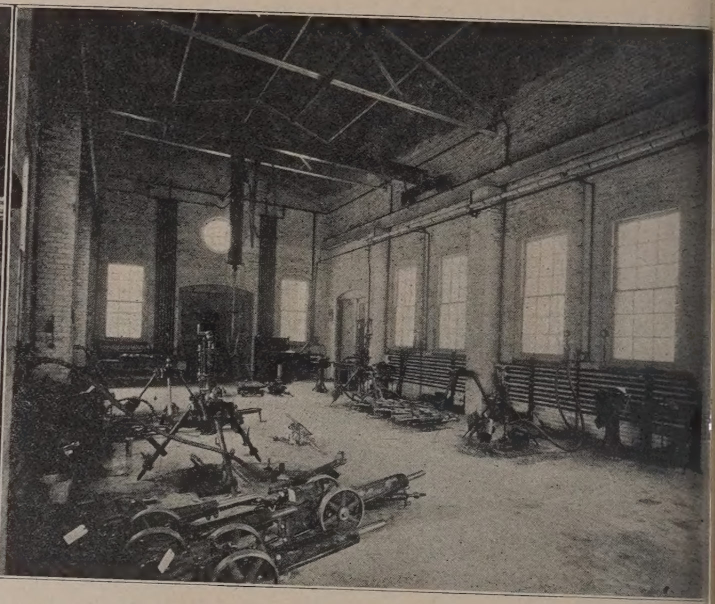
Foundry.—The foundry is one of the most important departments of the plant. It is a 500x160-ft. building, the equipment embracing four cupolas and eight core ovens. A novel feature of the exterior surroundings is a system of storage bins at the side of the building upon which the cupolas are located, which are of importance in facilitating the handling of coke, pig and scrap iron, sand, etc. This arrangement, which is shown in the cross-section, was favored by the contour of the land at this part of the site, which was formerly a side hill of gradual slope. Advantage was taken of this to bring the level of the foundry floor 18 ft. below the main plant level. A concrete wall and series of open storage bins were built opposite the cupola side of the foundry, over which are built tracks so that hopper cars may be discharged directly into the bins. For all materials used on the upper or charging-floor level, space is provided on top of the bins. Steel bridges connect this elevated storage space with the charging floors for the various cupolas, so that the charging material may be wheeled in directly to the charging do s, for which narrow-gauge industrial railways e provided.

The building is divided into a main bay o ft. in width and two side bays of 50 ft. ea Star ventilators are installed every 40 ft. ll parts of the foundry are commanded by elec c traveling cranes, those in the main bay being f 20 tons capacity, and those in the side bays o tons. Also a 10-ton crane spans across e storage area between the foundry and the patt shop, this section of the yard being used for e storage of flasks.

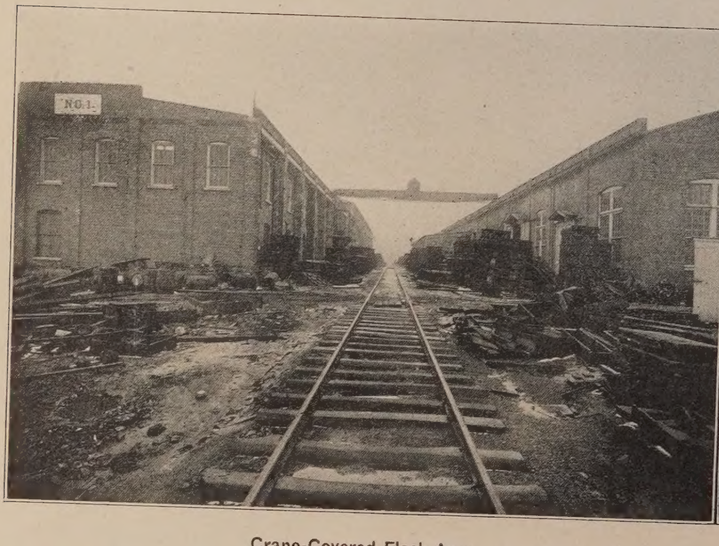
The foundry equipment consists of two 8- in. cupolas, one 78-in. and one 68 in. in size. Ea is supplied with a motor-driven blower set. On either side of either group of cupolas is arranged a double core oven of large size. Each half of each oven accommodates a large four-truck car for the handling of large cores for baking.



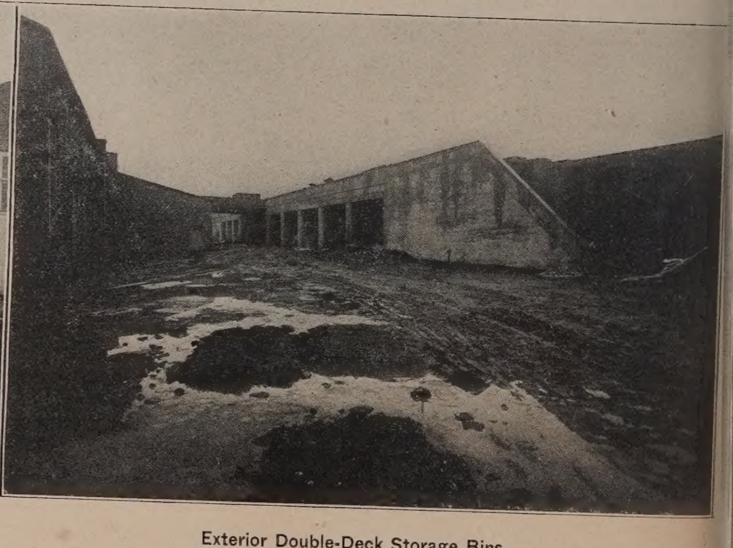
General View n Compressor Erecting Shop.



Testing Department for Rock Drills and Coal Cutters.



Crane-Covered Flask Area.

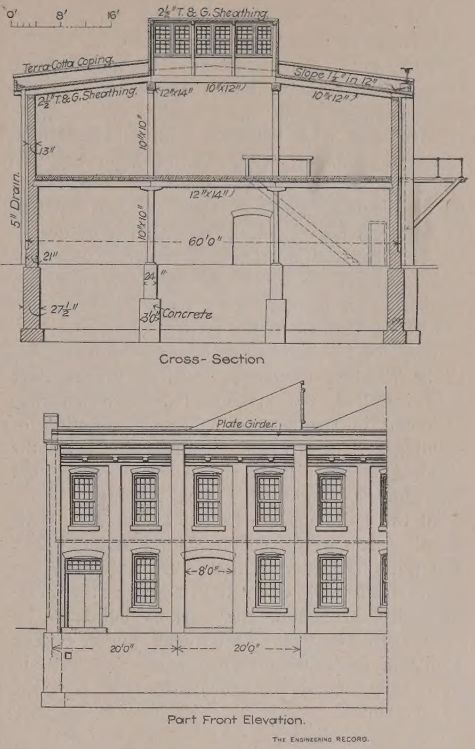


Exterior Double-Deck Storage Bins.

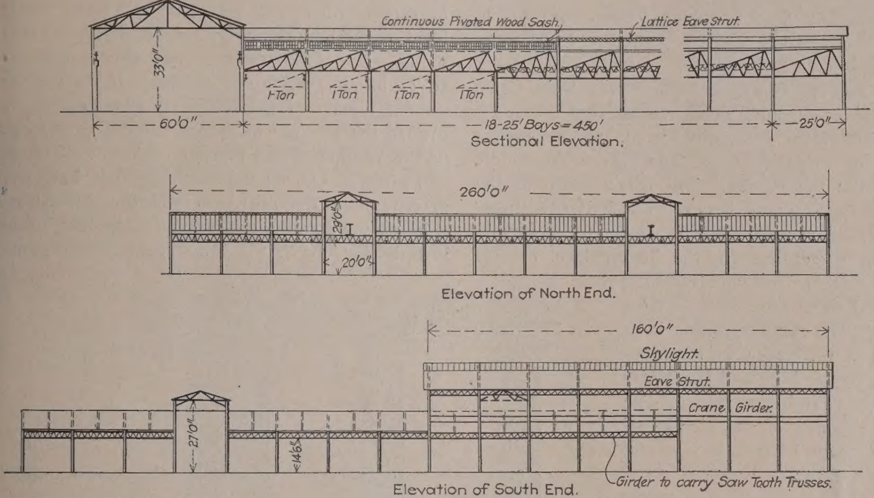
Elaborate lavatory facilities are provided also in this shop for the convenience of the workmen. In the washroom expanded metal lockers are furnished the workmen in acordance with the best shop practice. The office facilities are also conveniently arranged, as may be noted.

Minor Buildings.—There are three additional shops adjacent to the foundry which serve as auxiliaries, these being the pattern shop, the pattern storage building, and the castings cleaning shop. The pattern shop and the storage building are two and three stories high, respectively, and are both of mill construction. The lower floor of the pattern shop contains pattern repair and carpenter sections, while the upper floor is divided into pattern-making and wood-working tool sections. A feature of this shop is the saw-tooth arrangement of the middle section of the roof. The saw-tooth lights cover the 20-ft. span between the central columns of the building, while the balance of the roof at the sides is sloped in accordance with the usual roof construction of this type.

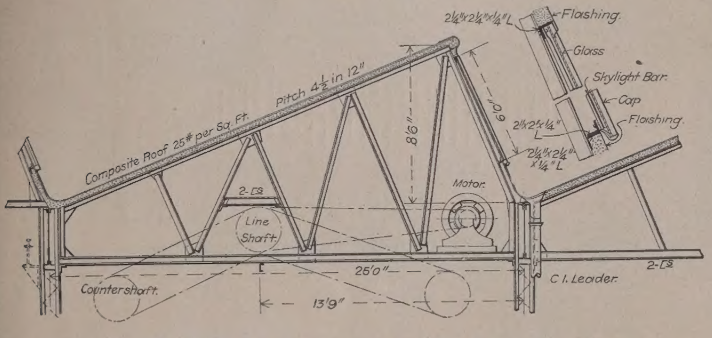
The pattern storage building is divided longitudinally into seven sections by fire walls, so that there are 21 storage rooms in all. The intervening doors are of the fireproof self-closing type, and all window frames are also fireproof. Every room is equipped with a wet sprinkler system, as is also the case in the pattern shop. All three floors are served by a hydraulic ele-



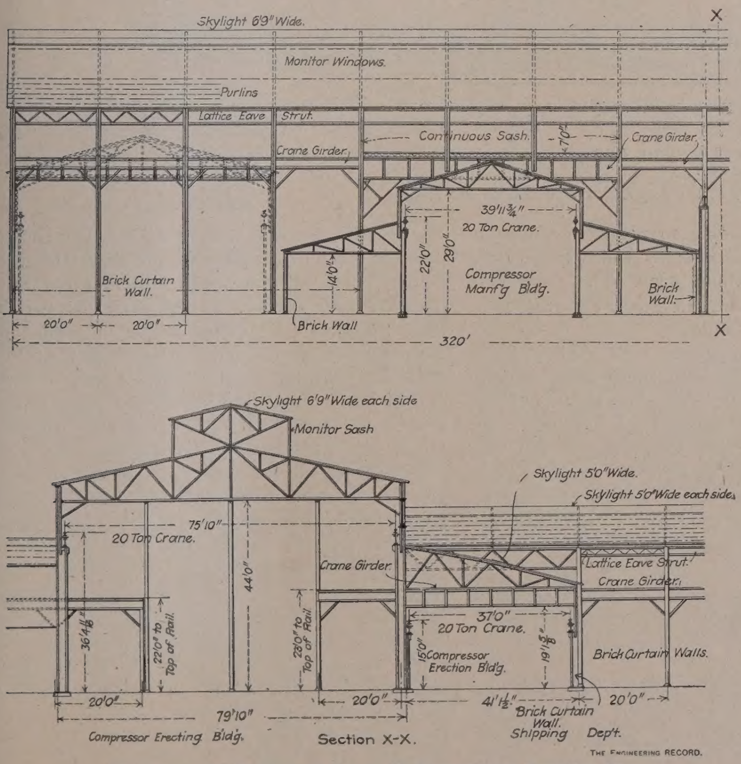
Detail of Pattern Shop.



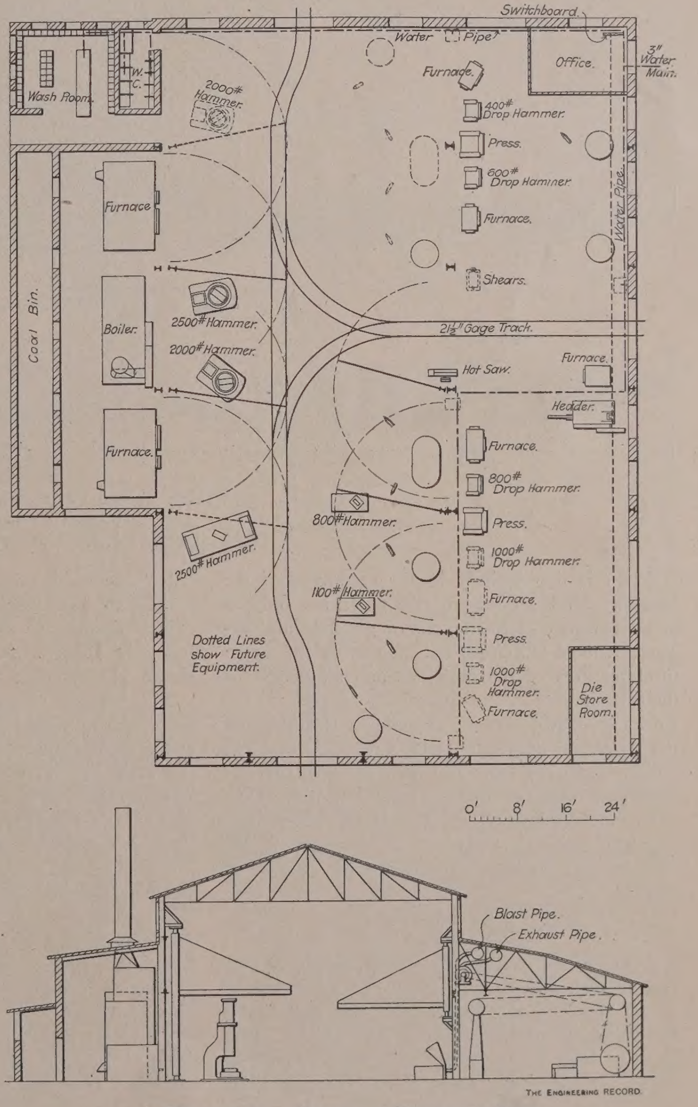
Steel Framing in the Large Rock Drill Manufacturing Building.



Saw-Tooth Roof and Arrangement of the Group Drive Motors.



Elevation and Section of Large Air-Compressor Erecting Shop.



Plan and Cross-Section of Blacksmith Shop.

vator employed for the handling of patterns.

The use of a separate building for cleaning of castings is something of a novelty in foundry practice, but is here warranted by the immense size of the foundry and the quantity of material handled. This shop consists of a 160x80-ft. steel and brick building, similar in design to the main foundry, with a 30-ft. main bay and two 25-ft. side bays. The main bay is traversed by an electric traveling crane for the handling of large castings, while in one section of one of the side bays a jib crane is installed. The principal features of this shop are two sand-blast rooms, which are used for a variety of work that cannot be handled in the rattlers.

In all of the buildings where heavy pieces are to be handled electrical traveling cranes have been installed, the arrangement of which may be noted in the accompanying cross-section of buildings. These cranes were supplied by the Pawling & Harnischfeger Co., Milwaukee, and the Morgan Engineering Co., Alliance.

All the buildings are heated by the Evans-Almirall system of forced circulation of hot water. The water is heated at the power station by exhaust steam and circulated through the heating coils throughout the various buildings by steam turbine-driven centrifugal pumps. The details of the heating system will be referred to more fully in a later article descriptive of the power plant.

Credit is due entirely to the engineers of the company for the design of the plant, not only as to all features of the layout of grounds and arrangement of buildings, but also as to the structural features of the buildings and all details of their equipment. The officials in charge of the work were Mr. W. L. Saunders, President of the Ingersoll-Sergeant Drill Co; Mr. Geo. R. Elder, vice-president and general manager in charge of operation of the plant; Mr. Wm. Prellwitz, chief engineer, and Mr. H. W. Zook, mechanical engineer. Mr. R. T. Stewart is the constructing engineer in charge of installation work.

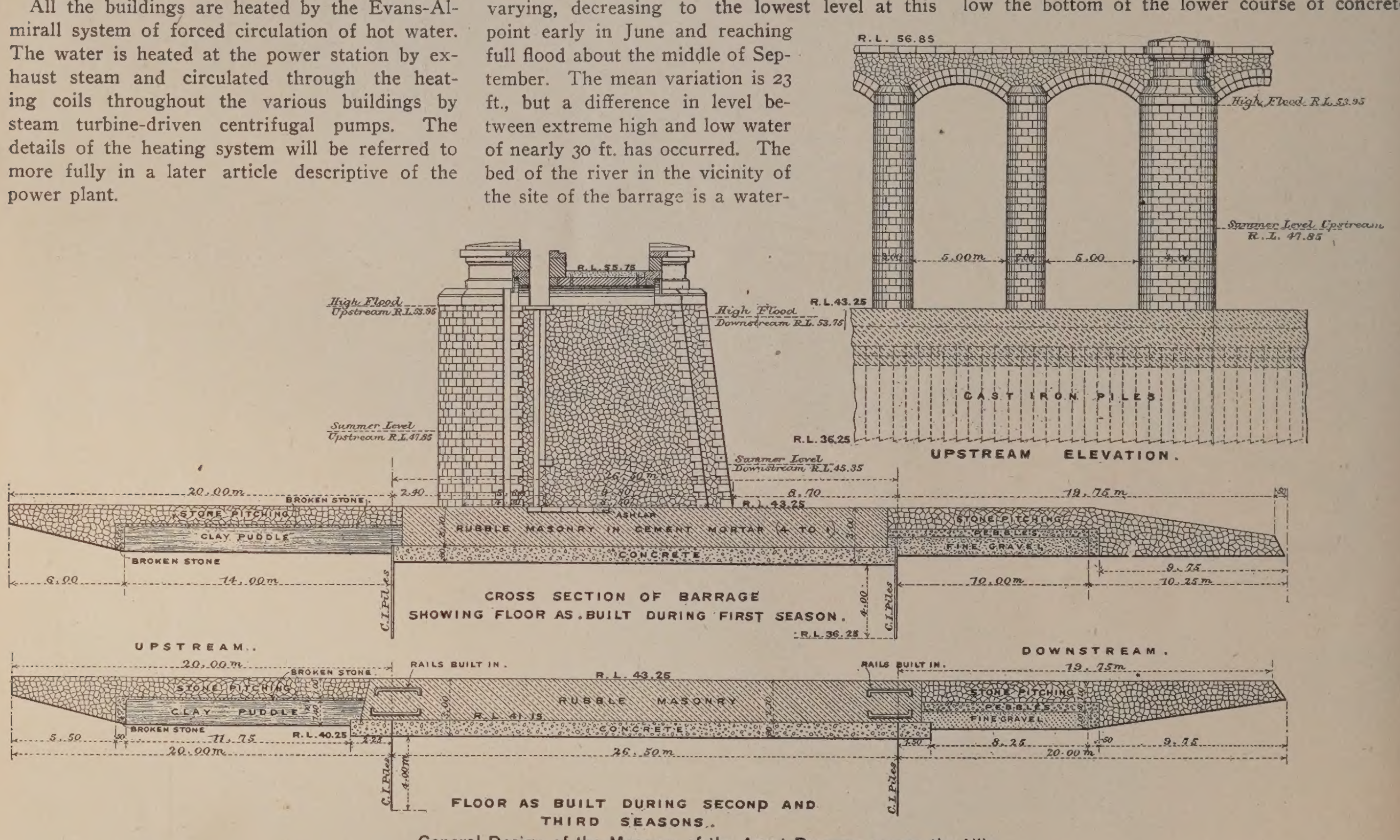
(To be continued.)

A Flume of 3x10-in. fir planks, spiked face to face in such a manner as to give a closed conduit 10 ft. square, inside dimensions, the walls being the thickness of the width of the planks, or 10 in., has been in use about five years, supplying water for the power plant of the Olympia Light & Power Co., at Tumwater, Wash. It carried about 100 ft. of water per second.

The Asyut Barrage Across the Nile.

The barrage across the Nile at Asyut was built to raise the level of the river during the summer and to insure delivery to irrigation canals of the additional supply of water provided by the recently constructed reservoir at Assuan, thereby allowing a larger portion of middle Egypt to be placed under perennial irrigation. It may also be used in raising the river level during low floods to deliver the flood supply to the canals. The construction was in charge of Mr. George H. Stephens, and from a valuable paper by him before the Institution of Civil Engineers, the following notes have been taken.

The barrage is 246 miles by river from Cairo and a short distance downstream from the starting point of the Ibrahimia Canal, which supplies water for irrigation to a large portion of middle Egypt and the Fayum. The mean width of the Nile at Asyut varies between one-half and three-quarters of a mile, and its level is continually varying, decreasing to the lowest level at this point early in June and reaching full flood about the middle of September. The mean variation is 23 ft., but a difference in level between extreme high and low water of nearly 30 ft. has occurred. The bed of the river in the vicinity of the site of the barrage is a water-laden fine sand, extending to a great depth and subject to many yearly changes which take place chiefly during the falling flood. The flood velocity is about 4 miles an hour, and the low water velocity about 2 miles.



General Design of the Masonry of the Asyut Barrage across the Nile.

The barrage is a masonry arch viaduct, built on a masonry footing, with sluice gates closing the arch openings, and with sufficient width of the arches to carry a roadway for cart traffic on top of them. A masonry lock, 216.5 ft. long by 52.5 ft. wide, with lock gates of the usual English pattern, is built at one end of the barrage and in connection with it. A solid weir to raise the water level would not have been feasible at this point, as it would have raised the level of the river above that of its banks even in an ordinary flood, and another serious objection was presented to such a structure by the large amount of silt carried by the Nile.

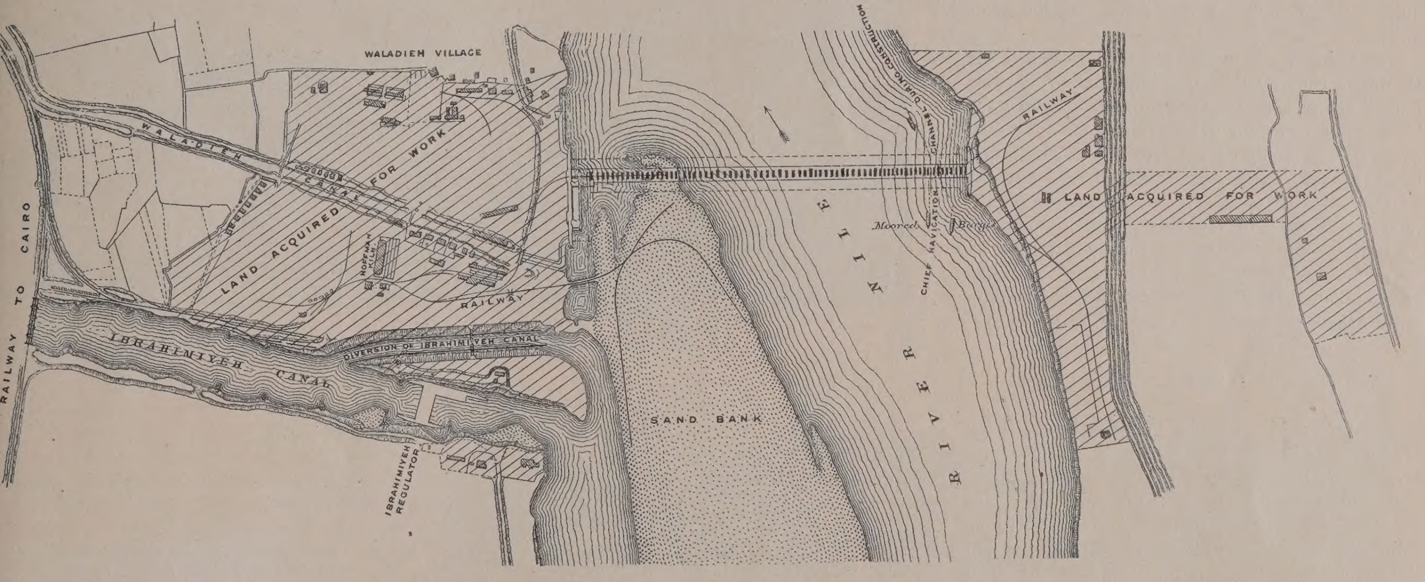
The total length of the masonry, including the lock, is 2,734 ft., and the height of the superstructure from the top of the footing to the top of the parapet wall over the arches is 13.6 ft. The sand in the bed of the river extended to such a depth that there was no advantage to be gained in carrying the footings much below the surface, and as this sand was unusually porous and subject to much shifting, the footing had to be designed to prevent, if possible, any liability of seepage through it beneath the masonry. The bed of the river on both sides of the footing was covered with rip-rap for a considerable width and depth as an added protection against scour and the formation of underground channels to that afforded by the design of the footing.

The footing proper is 87 ft. wide and 9 ft. 10 in. thick, with its top 3 ft. 3 in. below the average level of the bed of the river. The bottom 2 ft. 11 in. are of 1:3:6.5 concrete, and the remaining 6 ft. 11 in. of random rubble masonry, set in 1:4 cement mortar in the lower part and 1:2 mortar toward the top, the mortar averaging 42 per cent. of the volume of the masonry. A row of tongue and grooved cast-iron sheet piles, 16 ft. long, were driven along the upstream and the downstream sides of the footing, and extended 13 ft. 1 in. below the bottom of the lower course of concrete. The tongues on the piles were made a little shorter than the depth of the grooves, and the extra space in the joints was filled with cement grout after the piles were driven. In the early part of the work the piles were driven at the upstream and downstream edges of the footing, with their tops flush with the top of the concrete in the lower part of the footing, and the masonry above started 1 ft. 8 in. back from the edge of the concrete. Later in the work the concrete was extended about 7 ft. 4 in. beyond the sheet piles on the upstream side and about 5 ft. beyond them on the downstream side. The rubble masonry was brought to within 1 ft. 8 in. of the edge of the concrete on both sides, covering the tops of the piles. Steel rails, 9 ft. 10 in. or more in length, with bent ends, were laid transversely in the masonry over the piles to strengthen it against upward pressures.

The rip-rap was laid about 66 ft. upstream from the line of the upper row of sheet piles and 65 ft. downstream from the lower row. It extends from the level of the top of the rubble masonry of the footing to a few inches below the top of the concrete and is decreased in thickness oward its outer edges. The stones used in it aried from 1 to 2 ft. in length on their longest ides, those in the lower part being thrown in oughly, but those in the surface were laid by and. Laid in this manner the rip-rap prevented ny scour with a stream velocity of 6 miles an our, occasioned by confining the channel during onstruction.

Clay puddle was laid for a width of nearly 46 t. and to a depth of 4 ft. 7 in. beneath the rip-ap adjoining the upstream side of the footing, layer of small broken stone being placed be-ween the stone in the rip-rap and the clay. A ft. 11 in. layer of sand and gravel, 34½ ft. wide, vas laid beneath the rip-rap next to the footing n the downstream side, the sand on the bottom nd the layer graded off to coarse gravel on top. The puddle on the upstream side was laid to cut ff any springs that might occur in the river bed, vhile the sand and gravel were placed on the lownstream side to give a free flow to such prings as existed under and below the barrage.

There are one hundred and eleven 16 ft. 5 in. rch openings in the barrage, each of which may e closed by two sluice gates. The piers between he openings are regularly 6 ft. 7 in. wide and 42 t. long, with abutment piers, 13 ft. 1½ in. wide nd 50.5 long, placed at every ninth opening. The luice gates are simply sliding doors, and are aised and lowered by chains on winches which ravel on tracks laid the length of the double walls f the barrage. The gates can be suspended at ny height, and during floods they are drawn up ut of the cast-iron grooves in which they are perated and placed on top of the piers.



General Plan of the Nile and its Borders at the Asyut Barrage.

The construction of the barrage was begun in une, 1898, and was finished in March, 1902. No bstructions could be placed in the river during loods, and the actual working season was thus imited to the time between the river reaching bout a certain level in the fall and the rise of he flood, which occurs toward the end of Decem-er and the end of July, respectively.

At the beginning of the work, a large sand bar ear the west bank extended about a mile up-tream from the site, and as its surface was ex-osed about 4 months of the working season, it vas used as a storage site for materials and sup-lies during the first and second working seasons. The preliminary work was not finished until after he summer rise in 1898, and construction proper egan in December of that year. A coffer-dam, onsisting largely of rubble stone, and connecting he west bank with the sand bar in the river, was uilt first to partially arrest the current in the leep channel along that bank. When this dam was finished an earthen coffer-dam enclosing the site of the lock was built and operations were begun on the footing and the masonry at that end.

Beginning at the banks, successive sections of the masonry and rip-rap were laid to the middle of the river, each section being enclosed by coffer-dams. When a section was finished, coffer-dams were built for the adjoining section, the dams around the completed section removed and the river diverted over the finished masonry. The extreme height of the coffer-dam between the sand bar and the west bank was 32 ft. 2 in. Stone was first thrown in on the bed of the river over the whole site to prevent erosion, and then the stone in the lower part of the dam was thrown in from boats so as to bring it up in horizontal layers. All the coffer-dams were constructed in the same manner. The bed of the river under the sites of the earthen dams where the current was at all strong was paved with bags of sand before the dams were commenced.

The top width of the dams varied between 16.5 and 26 ft., and their side slopes from 3 to 1 to 6 to 1, with a difference in level of as much as 18 ft. between the water within the dams and the water in the river. The material used in the coffer-dams was usually of the poorest description, being chiefly silt taken from the sand bar in the river or from the foundation trenches. It was so fine that much of it when used in bags oozed through the canvas, and bags taken out of the water after being used frequently contained only half of their original contents. It readily percolated with the water through the tongue and grooved timber piling used at the back of the lock wall, filling up the excavated site and could only be kept out by laying closely woven canvas on the bottom of the excavation and up the face of the timber piles.

The water-laden silt forming the bed of the foundation trench was alive with innumerable small springs which became apparent as soon as the water within the coffer-dams was lowered enough by pumping to expose the bed of the river. The small springs often developed into large ones and gave much trouble whenever any delay occurred in placing the foundations, although the water level in the foundation trench was kept slightly higher than the level of that in the remainder of the area enclosed by the coffer-dams. The springs were specially troublesome in parts of the trench immediately in front of any finished portion of the footing, where instead of gradually increasing in flow they would often burst forth without warning, the flow from them being as much as could be passed through a 7 or 8-in. pipe. Small sand-bag enclosures were made around such springs, and the water allowed to rise within them until it became quiescent. These conditions in the foundation required the excavation of the footing trench to be started as soon as the bed of the river was exposed, and the floor laid with the least delay possible after the excavation had been completed.

The method finally adopted and generally followed in laying the concrete in the lower part of the footing after several other ways had been tried was to deposit it in three layers, the bottom one 1 ft. 8 in. thick and the other two each 8 in. thick. The water in the excavated footing trench was kept 1 ft. 8 in. deep, and the lower layer of concrete laid through the water and trodden in place by natives standing in the water. The other two layers were well rammed. This concrete had to be laid very cautiously, and when any of the small springs appeared to be developing into larger ones the work near them was suspended and vents provided for the water. Vent holes were left every few yards and sealed up after the concrete had been laid a sufficiently safe distance ahead.

After the water had stopped rising in the wells formed by the rows of sand-bags placed around the holes, the holes were sealed with concrete, which was usually deposited in closed chutes. The holes to be plugged were 8 or 9 ft. in diameter in some instances, and in some of them the water did not cease to rise until it had reached the top of the footing. The concrete used in sealing the holes had to occasionally be brought up to within 2 ft. of the top of the masonry in the footing; usually, however, only a concrete plug was laid, and after it had set, the water was pumped out and the masonry laid in the usual manner.

Iron pipes, extending through the concrete in the vicinity of the springs, were placed vertically in it as it was laid, and a few days later additional sections of pipe from 16 to 20 ft. in length were screwed on to these and cement grout forced down beneath the footing in order to fill any channels that had begun to form in the sand foundation.

The concrete next to the cast-iron sheet piles was generally laid in advance of that in the remainder of the footing to prevent springs from developing near the piles. Whenever a sufficient number of vent holes had not been left and the suppressed springs forced their way through the green concrete, a section of the concrete was removed, and the space left open until it could be safety sealed.

A large pumping plant was required to keep the level of the water within the coffer-dams sufficiently low to permit construction to be carried on. During the early part of the first season's work four 12-in., two 10-in., six 8-in., and three 6-in. centrifugal pumps were in operation. Four 12-in. pumps were added to the equipment during the latter part of that season, and better progress could have been made if more pumps had been available. In the second season nine more 12-in. pumps were added, this size having been found to be the most adaptable to the work, as 18-in. pumps proved to be too unwieldy, and the smaller ones did not have sufficient capacity to be used as main pumps.

During the first season the cast-iron sheet piles were driven and the masonry of the footing completed for a length of about 800 ft. out from the west bank, considerable rip-rap was laid and some of the masonry in the lock and in the arch piers at the west end was built, a little more than one-quarter of all the work being finished. During the second season work was advanced from both banks. The sheet piling was all driven, the footing masonry nearly completed and a large amount of pier masonry laid, about three-quarters of the construction being finished at the end of that season. The footing was completed the third season, and during this and part of the following season the remainder of the masonry was laid and the filling and grading on the banks of the river finished.

Regulating works were built at the head of the Ibrahimia canal at the same time the barrage was built and are a part of the project, in which the barrage in included, of providing an additional and uniform supply of water to the irrigation districts tributary to this canal. The regulator works consist of a masonry arch viaduct about 400 ft. long and similar to the barrage in design and operation. The conditions at their site were very much the same as those met with at the barrage, and similar methods were followed in building both structures.

The Loss of Water by Evaporation.

A number of valuable investigations of the evaporation of water have been made in this country, notably those under the direction of Mr. Desmond FitzGerald. The data on the subject are still so few, however, that the work being done jointly by the Office of Experiment Stations and the State of California is likely to prove of much importance. It is under the direction of Prof. S. Fortier, who has recently published the following notes concerning the progress of the studies to date:

For the past eighteen months experiments have been conducted for the most part in iron tanks filled with either water or soil, to determine the amount of loss by evaporation and the influences which affect it. The ultimate purpose of the investigation has been to discover practical means of lessening this enormous loss.

The monthly evaporation from tanks filled with water and placed in earth at each of the places named is given in the accompanying summary. Similar observations are now being carried on at Berkeley and Chico. It was thought that these five stations would represent the prevailing climatic conditions of the irrigated portions of the State.

At Calexico, in the Imperial Valley, the weekly evaporation in January was never less than seven-eighths of an inch, and in June and July it was occasionally as high as 3⅜ in. At Pomona the lowest weekly evaporation occurred in February and was less than one-half inch, while in July it was 3 in. At Tulare, in midsummer, the greatest loss per week was about 3¼ in., and in midwinter, during periods of frost and fogs, there was little, if any, loss. Since the station was established at Berkeley, the greatest loss occurred between Sept. 10 and 17, when it was 1¼ in. The weekly loss in November averaged three-eighths of an inch.

SUMMARY OF EVAPORATION LOSSES FROM WATER SURFACES, AT TULARE, POMONA, AND CALEXICO, CAL., FROM JULY 1, 1903, TO JULY 31, 1904.

	Tulare.	Pomona.	Calexico.
1903:			
July		9.07 in.	14.48 in.
August	12.34 in.	9.37	12.72
September	9.05	6.29	10.29
October	6.32	6.63	7.50
November	3.51	4.25	4.80
December	2.00	2.51	4.52
1904:			
January	1.46	2.78	4.39
February	2.98	2.57	6.32
March	1.77	3.69	8.86
April	3.75	5.00	9.55
May	8.64	6.50	10.91
June	10.66	8.20	13.89
July	12.20		
Total	74.68	66.92	108.23

An experiment was carried on in the summer of 1904 at Berkeley to determine the effect of temperature on the rate of evaporation. For this purpose six tanks were used. Ice and sawdust were packed around two tanks to lower the temperature, and oil lamps were kept burning continuously beneath two others to raise the temperature. The remaining two tanks represented natural conditions. The following summary, which gives in brief the average results, confirms the records obtained from different parts of the State, viz., that the amount of evaporation is largely dependent on the temperature of the water:

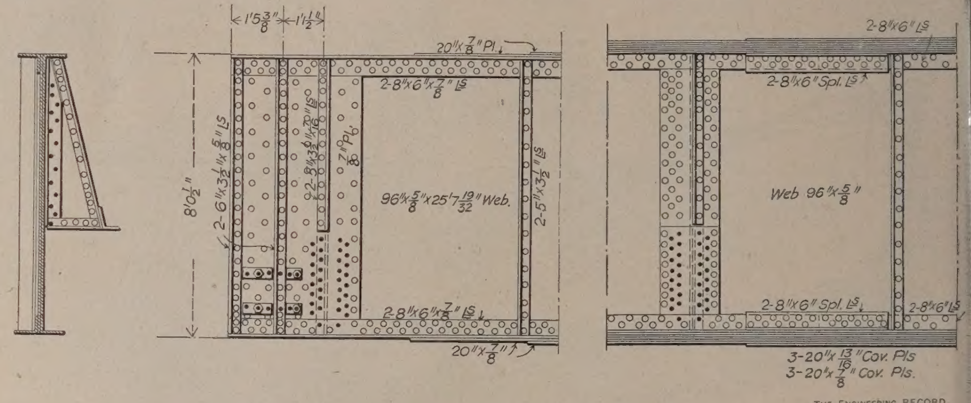
Water temp., Fahr.	55.5°	62.0°	69.2°	80.1°	89.2°
Weekly evap.	0.42 in.	0.77 in.	1.54 in.	3.08 in.	3.92 in.

Similar experiments have been conducted during the past year and a half for the purpose of gaining more definite information in reference to the rate of evaporation from cultivated soils. For lack of time the results have not been compiled, but the records seem to show that this question is complex in its character. The loss of water from this cause would seem to depend on the amount of moisture in the soil and its temperature. It is likewise influenced by the character of the soil, condition of the atmosphere, wind, etc. It may be stated in a general way that the loss from June 1 to Oct. 1 on bare irrigated soil in southern California was from 1 to 2 in. per month. Assuming that the price of one-fifth of a miner's inch is $6 for the season, the loss from this cause would annually amount to from $2 to $4 for each one-fifth of a miner's inch.

Typical soils from Redlands, Riverside, Fullerton and Pomona have been placed in tanks at the Pomona station under the charge of Mr. J. H. Barber. Each kind of soil has been irrigated in three ways to correspond with the different methods: (1) In which the surface is flooded; (2) with shallow, and (3) with deep furrow methods, in which water is applied at the bottom of furrows 3 and 12 in. deep, respectively. The results thus far indicate that surface flooding is most wasteful and that deep furrows conserve much more water than do shallow furrows. The average cubic feet per acre evaporated under each method during September and October, 1904, was as follows: Surface irrigation, 6,428; shallow furrow irrigation, 5,581; deep furrow irrigation, 4,811.

An 89-Ft. Skew Plate-Girder Bridge.

The double-track through plate-girder skew bridge for the crossing of the Reading Belt R. R. over the tracks of the Pennsylvania Schuylkill Valley Railroad has two 89-ft. 4-in. girders, 96 in. deep, with a beam and stringer floor. The web has a uniform thickness of ⅝ in., and is made in lengths of from 18 to 25 ft., spliced with double cover plates, and six vertical rows of rivets. The upper edges of the middle, intermediate and end sections of the web are ⅛, 3/16 and 7/32 in. longer than the respective lower edges to frame a camber of 1 in. in the girder. The maximum flange section consists of two 6x8x⅞-in. angles with the 6-in. flanges vertical, and three 20x⅞ and three 20x13/16-in. cover-plates. The cover-plates are without splices, the longest being about 72 ft. long. Each flange angle is made with a 29-ft. 4-in. and a 60-ft. length, all joints being opposite each other, and spliced with pairs of 8x6x29/32-in. angles 4 ft. long, milled on the back to fit the root of the flange angle and having the flanges project slightly beyond the flanges of the girder angles.



THE ENGINEERING RECORD.

An 89-Ft. Skew Plate-Girder, Reading Belt R. R.

The floorbeams are 11 ft. 4½ in. apart, and their lower flanges are flush with those of the girders. The ends of their upper flanges are flange-connected to triangular gusset plates bracing them to the webs of the girders. Horizontal connection plates are riveted to the girder and floorbeam lower flanges to receive the lateral diagonal angles. The girders are seated on cast pedestals and rockers at the fixed and expansion ends, and weigh about 88,000 lb. each, including the 48,000-lb. cover-plates. They were shop-riveted complete. They were designed and erected under the direction of the engineering department of the Philadelphia & Reading Ry., Mr. W. Hunter, chief engineer, and were built by the Phoenix Bridge Co.

A LARGE ROCK-FILL DAM is about finished near Victor, Colo. It will be 91 ft. high, with a steel-lined water slope of 30 deg. with the vertical and a back slope of 53 deg. The steel sheets for the lining are 15x5 ft. The long horizontal seams are double-riveted. The vertical joints are made by riveting the 4-in. leg of a 5x4-in. angle to each end of the plates. The long legs of the angles of adjacent sheets butt together and are riveted along their outside edge, so that the sheets can expand and contract somewhat without tearing. Wire ropes are attached to the back of this lining at frequent intervals, and carried back to old rails buried in the rock fill. This structure is known as the Beaver Creek dam.

struction of Sections 3 and 4, Riverside Drive Extension, New York.

he general features of the heavy work in-
ed in the extension of the Riverside Drive in
 York were described in The Engineering
ord of Feb. 11. The extension has in most
es a 58-ft. carriage road, an 18-ft. bridle path
two 15-ft. sidewalks separated from the road-
 and path by 5-ft. strips of parking. Sections
d 4 extend from 145th to 158th St., and the
k on them consists principally of rubble and
stone retaining walls with concrete founda-
, excavation, back-filling, and grading, besides
t-stone arch 100 ft. long of 40-ft. span and a
 viaduct. The principal quantities involved
he contract for both sections include about
o yd. of rubble masonry, 35,000 yd. of cut-
ite ashlar masonry, 15,000 yd. of concrete,
oo yd. of excavation, and 250,000 yd. of fill.
k is being carried on throughout nearly the
le length of both sections by a force of about
 men, exclusive of 80 stone-cutters in the ad-
nt yard and 240 men at the contractor's quar-
 in Maine. The plant consists principally of
t eight stiff-leg and eight guyed derricks
 capacities of from 5 to 15 tons each and
ns from 65 to 83 ft. long, all of them equipped
 Lidgerwood hoisting engines; the concrete-
ng plant, the service railroad, about 15 Inger-
Sergeant and Rand rock drills, several Cam-
 steam pumps, and a complement of flat cars,
p cars, hoisting skips and steel buckets of the
nary standard varieties.

Rubble Wall and Fill, Section 4.

l power is furnished by three 175-h.-p. hori-
al boilers, one of which is located at the con-
 plant and the other two at approximately
-distant points on the work. The steam is
eyed along the line in 4-in. pipes carried in
den boxes packed with stable refuse. These
 have a maximum length of about 500 ft., and
found efficient. After the retaining walls are
pleted, it is intended to install a special plant
rapidly handling the fill behind them. The
erial for this purpose will be received on
s, and unloaded by a boom derrick with a
-shell bucket delivering to a hopper that will
discharge on a belt-conveyor. The conveyor will run at an incline from the shore across the railroad tracks, and will discharge into large dump cars which will deposit the fill as required, and are expected to handle at least 1,600 cu. yd. in 8 hr.

Rear of High Rubble Wall, Section 3.

The west retaining wall, which is adjacent to the railroad tracks, has a wide concrete footing 5½ ft. thick, above which the ashlar masonry rises from about 18 to 50 ft. It is built in a trench from 5 to 20 ft. deep, and with a width equal to about half the height of the wall. Most of this trench was excavated in the dry through the characteristic micaceous rock of the neighborhood, but in some places it was dug through earth that required sheeting and a large amount of pumping. The concrete and stone were delivered along the line of the wall on 3-ft. gauge cars drawn by steam locomotives on a track laid on the bluff parallel to the wall about 50 ft. east of it, and were handled by boom derricks located between the track and the wall, usually about 140 ft. apart and moved forward from the rear to the front, as required by the progress of the work. The large quarry-faced dimension stones are shipped on schooners to the contractor's docks and taken thence by the narrow-gauge railroad to the stonecutter's yard opposite the concrete plant, whence they are delivered as required. They are noticeable for their uniform color and texture and for their large dimensions, many of them extending through the full thickness of the wall and some of them weighing 14 tons each.

All concrete is made with Lehigh Portland cement, and is mixed 1:3:5 except a small quantity of 1:2:4 required in the arch bridge. The concrete plant is located on a railroad float moored at the end of the contractor's dock, over which a viaduct trestle and a double-track truss bridge carries the narrow-gauge service track over the tracks of the New York Central R. R. to the top of the bank, where they are deflected about 90° and run parallel with the west retaining wall. A 30x50-ft. timber tower about 40 ft. high is built in the middle of the concrete float, and has on top two pairs of steel-lined hopper-bottom charging bins with a total capacity of about 12 cu. yd. The pairs of bins are separated about 12 ft. in the clear, leaving a space between and around them on the deck of the tower, which is used for handling cement bags. At each end of the float there is a stiff-leg derrick with a 65-ft. boom which delivers broken stone or sand from adjacent barges to the charging bins. At present only one derrick is installed at each end of the float, and handles either sand, which is hoisted with a clam-shell bucket of 2 cu. yd. capacity, or broken stone, which is hoisted with a 2½-yd. steel bail-dumping bucket manufactured by the G. L. Steubner Iron Works, Long Island City.

The plant was designed and has previously been operated with two derricks at each end, one of which delivered stone and the other sand. Under these conditions one of each pair of bins is filled with stone and the other with sand, and discharge their contents through bottom openings commanded by horizontal sliding steel gates operated by hand levers. On the floor below the bins there is a longitudinal track for a large hopper-bottom steel car into which the requisite amount of cement is first delivered from a charging hopper on the upper floor. The car is then pushed by hand under the twin bins and sand and stone are delivered to it. Afterwards, while it is discharging its contents to the cubical mixer in the story below, a duplicate car is being filled from the other pair of bins and so on, making the operation continuous. At present both bins in one pair are filled with stone, both in the other pair with sand, and only one charging car is in use, being pushed back and forth from one side of the tower to the other. The concrete is mixed in 2½-yd. batches, and is delivered in steel buckets seated on a car running longitudinally on the deck of the float. A boom derrick removes the bucket from the car and loads it on another car on the elevated trestle, whence it is drawn usually in three or four-car trains to the required point where it is to be used. Cement is stored on a barge alongside the concrete plant, and is delivered to the top of the tower in lots of about 75 bags hoisted by the derrick in steel buckets or wooden skips. As fast as it is emptied into the charging car, the empty bags are thrown through a chute in the floor, which delivers them to a storage room below. The work was designed and its execution is being conducted under direction of Mr. F. Stuart Williamson, consulting engineer.

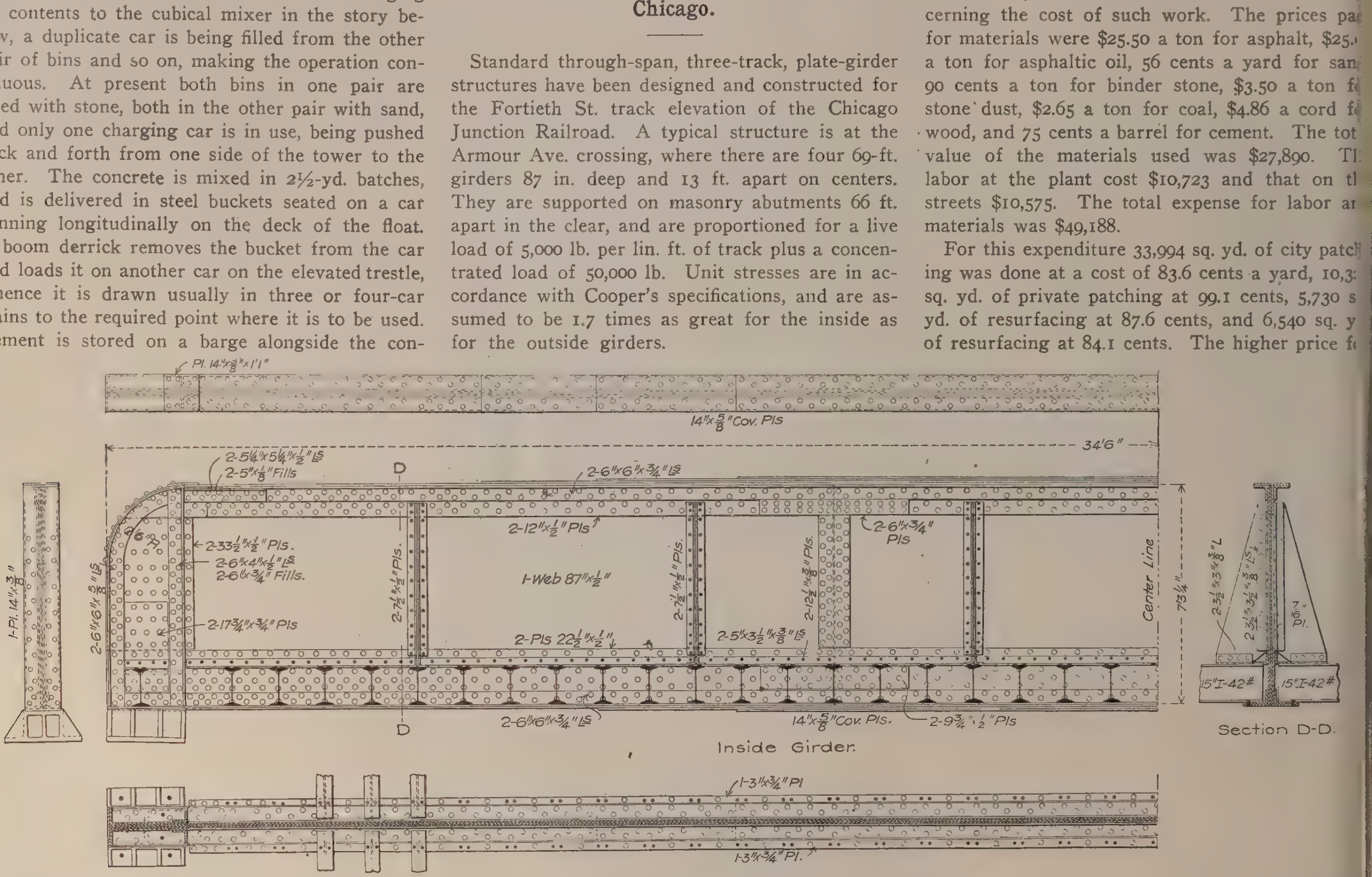
Mr. John C. Rodgers is the contractor for sections 3 and 4; Mr. John G. Tait, chief engineer; Mr. G. P. Seabury, assistant engineer and Mr. J. J. Haggerty, superintendent.

Seasonal Water Rates.

Unequal rates for water at different seasons of the year have been authorized by the Massachusetts Supreme Judicial Court in Souther v. Gloucester, 73 N. E. Rep. 558. Two points were settled. (a). Where a city water-works was extended to an outlying section of the city to serve persons living in summer cottages, who used water during a part of the year only, the fact that the construction of the works was a public use, to be paid for by taxation, did not deprive the city of the right to charge a higher rate for water so furnished than was charged in the center of the city. (b). The city, in determining the rate to be charged such users, was entitled to consider the expense of furnishing the water, the nature of the use, the special cost of extending the system, together with the interest on the cost of necessary special construction, and like items. This decision is a very satisfactory one to those who believe that municipal service of this character should be conducted on a business-like basis. Supplying water to summer cottages is a distinctly special business, for which special prices should be charged, just as such charges are made for special merchandise.

The Armour Avenue Plate Girder Bridge, Chicago.

Standard through-span, three-track, plate-girder structures have been designed and constructed for the Fortieth St. track elevation of the Chicago Junction Railroad. A typical structure is at the Armour Ave. crossing, where there are four 69-ft. girders 87 in. deep and 13 ft. apart on centers. They are supported on masonry abutments 66 ft. apart in the clear, and are proportioned for a live load of 5,000 lb. per lin. ft. of track plus a concentrated load of 50,000 lb. Unit stresses are in accordance with Cooper's specifications, and are assumed to be 1.7 times as great for the inside as for the outside girders.



The Armour Avenue Plate-Girder Bridge, Chicago Junction Railroad.

The end vertical angles are curved to correspond with the rounded upper corners, and are cut to butt against the square ends of the top-flange angles. The ends of the webs are reinforced to a total thickness of 2¾ in., and have pairs of vertical angles. There are no other web stiffener angles except at the transverse gusset plates which sway-brace them to the floorbeams, 9 ft. 1½ in. apart. The webs are made in three pieces, shop-spliced with four rows of shop rivets. The flanges are made with pairs of 6x6-in. angles with double rows of rivets in each leg, and are reinforced with 14-in. cover-plates and with web plates. The latter are 12 in. wide and have four rows of rivets for the top flanges, and are 22½ in. wide and have seven rows of rivets for the bottom flanges. The first cover-plates on the bottom flanges are 20 in. wide, and project beyond the flange angles to receive the floorbeam rivets. The flange angles and plates are made in single lengths, and the webs are spliced at the upper and lower edges with long plates. The floorbeams are spaced 18¼ in. apart, and are connected to the webs by long horizontal angles. There are no lateral angles or stringers, and the lower flanges of the girders have steel base plates planed to the grade of the track and seated on the planed tops of cast pedestals having outside longitudinal guide strips and stone bolted to the masonry. The girders were designed by Mr. W. M. Hughes, consulting engineer, and were approved by Mr. C. V. Weston, chief engineer of the Chicago Sou Side Elevated Railroad Co., and by Mr. J. B. Co chief engineer Chicago Junction Ry. Co.

The American Bridge Co., Mr. Paul Wolf chief engineer, was the contractor for the supe structure.

Municipal Asphalt Work in Detroit.

The operations of the municipal asphalt pla at Detroit in 1904, under the direction of Mr. A. Proctor, afford some useful information co cerning the cost of such work. The prices pa for materials were $25.50 a ton for asphalt, $25. a ton for asphaltic oil, 56 cents a yard for san 90 cents a ton for binder stone, $3.50 a ton f stone dust, $2.65 a ton for coal, $4.86 a cord f wood, and 75 cents a barrel for cement. The tot value of the materials used was $27,890. Th labor at the plant cost $10,723 and that on th streets $10,575. The total expense for labor a materials was $49,188.

For this expenditure 33,994 sq. yd. of city patching was done at a cost of 83.6 cents a yard, 10,3 sq. yd. of private patching at 99.1 cents, 5,730 s yd. of resurfacing at 87.6 cents, and 6,540 sq. y of resurfacing at 84.1 cents. The higher price f private work was due to the fact that the repai were breaks along street tracks where no bind could be used, and it was necessary to employ th more expensive topping material. Some of the r pairs were cuts in different parts of the city, wher the time lost in moving the men was considerabl The difference in the length of haul caused th variation in the unit cost of resurfacing.

In preparing these figures Mr. Proctor took n account of maintenance charges on the work don because there is such a great difference of opi ion respecting a proper estimate of this natur The work was done in the best possible mann the materials were the best obtainable and employed according to approved methods, and h expects very little expense for maintenance w be incurred within the usual guaranty period. A reference to the depreciation of plant was als omitted. The season's work last year was ve short, so that the wear was hardly appreciabl and no repairs of any sort were needed.

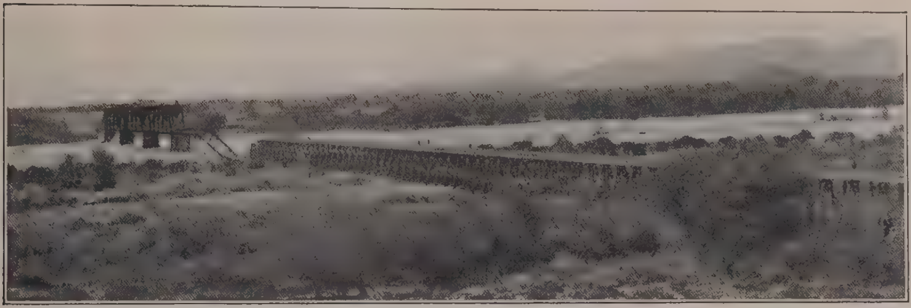
The average analysis of the mixtures used o patchwork was 10.98 bitumen, the limits bein 10.55 and 12.53 per cent. On resurfacing th averages on two streets were 12 and 11.93 pe cent. The average result of sand siftings for th season was 6 per cent. retained on a 20-mes sieve, 16 per cent. on 40-mesh, 26 per cent. on 6 mesh, 23 per cent. on 80-mesh, 11 per cent. o 100-mesh, and 18 per cent. passing a 100-mes sieve.

Bridge Troubles in Southern Arizona.

By H. F. Robinson, City Engineer, Phoenix.

During the present winter southern Arizona has been visited by copious rains. For the past seven years the rainfall has been less than normal, and the condition for the past four years has been still worse. The normal rainfall for this section of the Territory, is from 7½ to 10 in. In 1904 the total rainfall for Phoenix was but 5.53 in.

Since Jan. 9 we have had between 11 and 12 in. As a result, all of the streams of this section, that normally are small or often dry, have been raging torrents. Both the Salt and the Gila rivers have been in flood all of this time and way beyond fording at any time.



The Phoenix & Eastern R. R. Bridge across Salt River.

The Maricopa & Phoenix & Salt River Valley Ry., a branch of the Southern Pacific, crosses the Gila on a long bridge, part truss and the balance trestle. The total length of this bridge is about three-fourths of a mile. The stream at this point runs through an alluvial plain and at high water the channel of the river "goeth where it listeth." This year the main channel has been far from the old main channel where the truss bridge is, and, as a consequence, in the ten weeks since the rains began the bridge has been washed out in part seven times, from 150 to 800 ft. and rebuilt six times. At present they are working to repair the seventh break of some 800 ft., in three sections. Sixty-foot piles have been driven, but the swirling waters pull them out and carry them down toward the Colorado.

On the night of March 20 two spans of the Phoenix & Eastern bridge over Salt River at Tempe dropped into the stream. The river opposite and below the city was higher on that night than it had been at any time this season, higher than it had been for 14 years. It overtopped all previous floods of the present season by 4 ft. This was a comparatively new structure, built in 1903 and consisted of a trestle approach of about 1,000 ft. from the north bank, five steel trusses of 203 ft. span and 50 ft. of trestle approach on the south bank.

The foundation of this bridge consisted of concrete piers resting on piling driven into the bed of the river, there being no rock here on which to construct the bridge. Each pier rested on 63 piles from 14 to 18-in. in diameter and about 35 ft. long. These were driven as deep as possible with a 2,000-lb. hammer with approximately 25 ft. fall, and sawed off at the river bottom. The piles struck a boulder bed not easily penetrated. The concrete was started about 8 ft. below the top of the piles and carried up with a batter of 1½ in. to the foot.

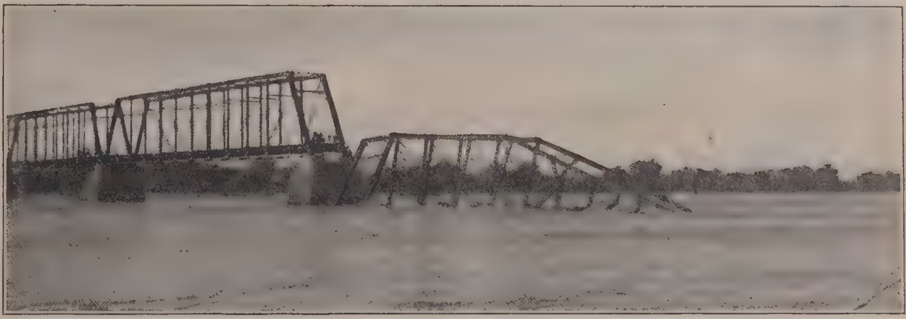
The channel of Salt River at this point does not shift much, but the current, being deflected above by cutting into the south bank, swung into the second pier from the north, undermined it, and when it fell, it toppled upstream, showing that the bottom of the pier was pushed from under the bridge. The first and second spans went with the pier, the first one falling flat and disappearing entirely under the water; the second one, being slightly deflected by the water as it fell, lies partly submerged. Last year high water dug around this pier considerably, and some 300 cu. yd. of rock were thrown in to fill the hole and to reinforce the pier.

Oiled Roads.

A few months ago there was printed in these pages a summary of the experience in California with oiled roads, as ascertained through a personal study of the subject by Mr. N. Ellery, state highway commissioner. That summary showed cases of failure as well as success, and in order to reduce the number of failures to a minimum, Mr. Ellery has recently made the following suggestions for carrying on such work:

No road which has been constructed without a proper foundation will ever be wholly successful. If a macadam road is being built, give thorough attention to the details of its base so that its capacity to resist the pressure from above is sufficient, and keep the density of the work as uniform as possible, so that weak spots or ruts may be reduced to a minimum. This applies equally to an earth road. Compact, as much as practicable, the roadbed, keeping always in mind that a smooth, even foundation makes a smooth, even surface. The neglect of the foregoing stamps the work as incomplete and without good road value.

Whatever be the kind of road, it should be well drained and ditched, so that the sub-grade will be as free from water as can well be made. In low, damp ground the roadbed should be raised high enough to prevent a saturated base; and on the roadside should be good, deep ditches conducting the water away from the road. With the oiled road the drainage should be such as to keep the water from getting under the oiled surface and creating a disagreeable oiled mud during the wet season. Experience with a number of oiled roads has proved this conclusively.



Second Span of the Phoenix & Eastern R. R. Bridge across Salt River.

The top layer should be worked down as perfectly as the means will permit. With the earth road heavy rolling cannot be overdone. Saturate the road material with water, but not excessively; practice will soon determine how much should be used. In the damp winter climate of central and northern California, it is well to give a good, heavy crown that the rain may be readily shed and thereby allow no chance for percolation to the sub-grade. Preparatory to the oiling, the surface should be dried out to a depth of at least 2 in., for oil will not mix with a wet material. Do not allow teams to pass over a road thus prepared, and break the surface irregularly, but loosen evenly just enough of the road surface to allow for the absorption and retention of the oil, otherwise it would run to the sides of the road.

The application should be by means of an oil wagon, which may be operated at will in spreading quantities necessary to a proper coating on the particular road being worked. There are several makes of good oil wagons on the market, any of which, properly handled, will do good work. However, the fact should not be overlooked that extra broad tires for such wagons are the best. After spreading the oil, cover it with a material to give it body. Sand has been preferably used for this purpose, because it is a natural absorbent of oil. Vary the application of sand just enough to cause the mass to be consistent, and allow no places where the oil stands free in small puddles. When this is accomplished, then the road should be rolled, beginning lightly at first and continuing more heavily as the mass becomes compacted, until there is no perceptible yielding. Now keep off the travel, if possible, until the oiled material has been allowed to set, and develop all of its asphalt qualities.

In the matter of whether hot or cold oil should be applied it may be said good oiled roads have been obtained by either process; but as cold oil is considerably cheaper, Mr. Ellery's preference is by all means for cold oil. The claim that hot oil penetrates faster and deeper than cold oil is, perhaps, not without some truth, yet as it takes some time after application for the asphaltic qualities of the oil to be asserted, there is no particular advantage gained, and with the present sanding method the cold oil is absorbed sufficiently for practical purposes.

The selection of the oil is a matter of vital importance. Always seek that quality which contains the highest percentage of asphalt. The proper plan is to have a test for asphalt made to ascertain the amount of such substance when the oil becomes dry. For this purpose an excellent test has been suggested by the State Mining Bureau: "Probably the best, certainly the simplest, test of the road-making value of an oil is to evaporate a weighed sample in an open metal dish, down to the hardness of commercial 'D' asphalt, and weigh the residue. We thus get at once both the original asphalt and that formed during evaporation, and while it is not likely that the percentage of asphalt thus obtained is the same as would be gotten by allowing the oil to dry in the sun, yet is highly probable that the comparison between different oils thus made is accurate. This test requires no apparatus except an iron or copper pan, a scale and a plumber's fire-pot, though it must be admitted that the even grading of the asphalt requires care and a little skill."

Practical Notes on Concrete Manipulation.

Some unusually valuable suggestions concerning concrete were contained in a paper read before the National Builders' Supply Association a few weeks ago by Mr. Charles A. Matcham, M. Am. Soc. C. E. It is not often that a manufacturer is also a user of a product, but this is true in Mr. Matcham's case, for he is not only the manager of the Lehigh Portland Cement Co. but has also been a user of large quantities of the material, particularly in buildings. Of course he had no suggestions for making good concrete with poor sand or stone or ashes, although he pointed out that by varying the proportions of the ingredients it is sometimes possible to make some improvement.

In the matter of mixing, also, he had no new suggestion to make for reducing the time required to secure thorough commingling. He advised mixing the sand and cement thoroughly dry, adding the stone and mixing the three dry, and not until then adding the water preparatory to the final mixing. For large operations, a mixing machine was strongly recommended.

The amounts of ingredients required to make a cubic yard of rammed concrete with different mixtures is given in Table I.

Side Walls.—Some of the buildings of the Lehigh Portland Cement Co. have concrete walls, which were described, with their method of construction, in this journal several years ago. The notes furnished for publication at that time were not so complete as the following general suggestions in Mr. Matcham's recent address:

In excavating for foundations, it is necessary to go sufficiently deep so that frost will not get below the foundation, which is generally 18 in. to 2 ft., or until reaching solid ground. For a small building, one story high, say 16 or 18 ft. wide by any length, 8-in. walls are sufficiently thick from foundation up; the first few inches of foundation should, however, be a few inches wider. The concrete should be mixed in proportions of one part cement, four parts sand, and seven parts stone.

If the building is a residence or warehouse two stories high, with no wider spans than 16 or 18 ft., then 10-in. walls would be necessary, and in such cases the foundation for about one foot in height is recommended to be a few inches wider. The concrete to be mixed 1:4:7.

Concrete House Built by Mr. Chas. A. Matcham.

Table 1.—Materials Required for a Cubic Yard of Rammed Concrete.

Mixtures.			Stone, 1 in. and under, dust screened out.			Stone 2½ in. and under, dust screened out.			Stone 2½ in. with most small stone screened out.			Gravel ¾ in. and under.		
Cement.	Sand.	Stone.	Cement, bbls.	Sand, cu. yds.	Stone, cu. yds.	Cement, bbls.	Sand, cu. yds.	Stone, cu. yds.	Cement, bbls.	Sand, cu. yds.	Stone, cu. yds.	Cement, bbls.	Sand, cu. yds.	Gravel, cu. yds.
1	2.0	4.0	1.46	0.44	0.89	1.48	0.45	0.90	1.53	0.47	0.93	1.34	0.41	0.81
1	2.5	5.0	1.19	0.46	0.91	1.21	0.46	0.92	1.26	0.48	0.96	1.10	0.42	0.83
1	3.0	5.0	1.11	0.51	0.85	1.14	0.52	0.87	1.17	0.54	0.89	1.03	0.47	0.78
1	3.0	6.0	1.01	0.46	0.92	1.02	0.47	0.93	1.06	0.48	0.97	0.92	0.42	0.84
1	3.0	7.0	0.91	0.42	0.97	0.92	0.42	0.98	0.94	0.42	1.05	0.84	0.38	0.89
1	4.0	7.0	0.83	0.51	0.89	0.84	0.51	0.90	0.87	0.53	0.93	0.77	0.47	0.81
1	4.0	8.0	0.77	0.47	0.93	0.78	0.48	0.95	0.81	0.49	0.98	0.71	0.43	0.86

For a more spacious residence or warehouse, which may be of considerable size, a 12-in. wall would be recommended. Where heavy loads, or machinery, may be required to rest on the floors, it would be necessary to engage the services of an engineer, as the thickness, weights, and strengths must be figured out practically and methodically. For such work it would be well to make the proportions of concrete for walls, one part cement, three parts sand, and six or seven parts stone, the proportions of sand to stone, however, to be determined by the size of the stone. The sand should be in proportion to fill all voids in the concrete.

Cellar Floors.—For cellar floors, where no heavy material of any kind is to set, proportions of one part cement, four parts sand and eight parts stone are recommended, the thickness of the concrete to be 2¾ in. with a top surface of ¼ in. plastered on the concrete as soon as the concrete is tamped down.

For cellar floors in warehouses where heavy trucking or storing is required, 5 to 6 in. thick concrete is recommended, and concrete should be made of proportions of one part cement, four parts sand and six parts stone.

Pavements and Curbs.—For pavements, curbs, gutters, driveways and stables, a concrete made of one part cement, three parts sand and five parts stone is recommended; the top surface, composed of one part cement and one and one-half parts sand, should be put on the concrete immediately after the work is laid, and should be well worked in with a trowel. While it is not so necessary to face off the side of curbing so quickly, it is better if same is put on as soon as sideboards can be removed.

Pavements should be laid off in blocks about 5x5, 5x6, or 6x6 ft. square—larger blocks than this may be cause for cracking. Care should be taken that the joints are perfect, leaving a clear space between each slab. For this purpose it is well to put a piece of thick soft paper, or tar paper, for separation; some prefer a piece of sheet steel, to be removed after blocks are made.

Oftentimes through carelessness of pavement layers, the joints are not perfect, and the joint through the top surface is not in line with under joint. Under such circumstances zigzag cracks will appear from ¼ to 1 in. from the joint line shown on the surface. A half-inch space at the ends of the pavements should be allowed to be filled in with sand on top of ashes, to allow for any expansion. Ashes are recommended to be laid below concrete pavements, 18 to 24 in. thick, according to the depth frost is considered liable to penetrate.

In laying the topping for pavements, care should be taken that there is not too much water in the mixture; water should not come to the surface in any quantity; the mixture should be made sufficiently pasty to work with a trowel. Mr. Matcham recommends for all pavement work a rough finish. It is not necessary with it to have the troweling a smooth pavement requires, it will not show hair cracks, it is easier to walk on in winter time, and is less expensive to lay, not requiring the time expended to make a smooth surface. Many cities are enforcing the rough surface to be made on all new pavements laid.

Hair cracks shown on pavements, or surfaces which have been plastered with cement and sand, are often attributed to the cement, the contractor complaining that the cement is too fresh, or has too much free lime. This is not usual, and is very seldom the fault. These hair cracks are invariably due to too rich a mixture for the topping, or to too much troweling, whereby the cement and water is brought to the surface, or too much water is added for the mixture. Either one of these are reasons for hair cracks.

The surface should be well plastered onto the under concrete, the topping should be leveled off with a straight edge laid on the scantling on each side which forms the width and height of the pavement. This straight edge should be worked gradually forward leaving a rough top. After this is partially set, or the water all absorbed, a smooth board should be used for troweling instead of a steel trowel, and only slight troweling is necessary; the less troweling that can be done on any kind of surface work, the greater the chances of successful work. Too much troweling aids to separate the cement from the sand, thus bringing a thin coating of cement to the surface, so that after a pavement is dried out, this thin scum of neat cement, which has been formed by the troweling, will soon wear off, leaving the bare sand for surface, and the cement having been drawn away from the sand underneath, the pavement will wear badly, and show patches of bare sand.

Finish.—Where a neat finish is required to a residence or warehouse, Mr. Matcham recommends a plaster composed of one part cement, one part lime, and five parts gray or yellow sand, according to color desired. For very fine work, two coats may be used, the first composed of one part cement and three parts sand, afterwards a thin coat of cement, lime and sand mortar. Voids in concrete will be found an advantage where plastering is to be done, and no fear may be entertained of the layers of plastering not adhering to each other, if properly applied.

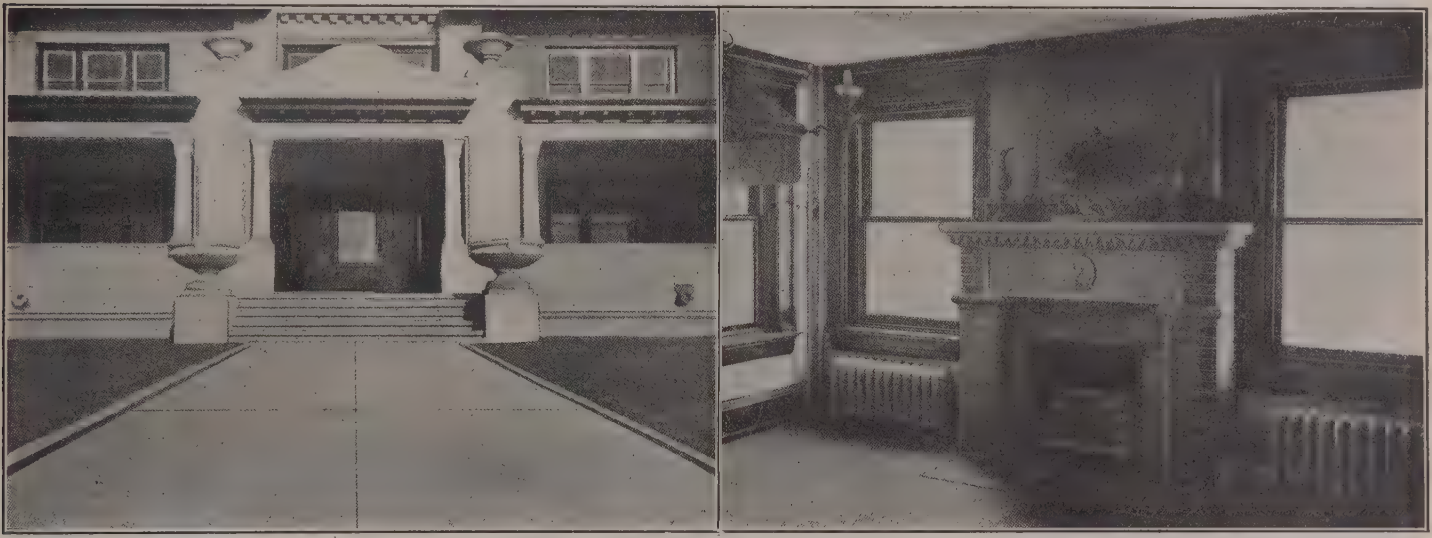
Before laying the plaster, the walls should be sprinkled with water for both the first and second coats. In each case the plaster should be rubbed hard on the concrete to cause adhesion, and while surfacing, water from a brush can be sprinkled, which will be found advantageous for good even surfacing.

Concrete Blocks.—There is a large and growing demand for building blocks, window sills, cappings, columns, and artistic work. A large number of companies are starting up, or are already in operation, in a number of both large and small towns throughout the States. There are numerous machines manufactured for making concrete blocks, which are mostly of the same principal, and give practically the same results.

As to the cost of making these blocks, from reliable information gathered from a certain factory, Mr. Matcham gives the following as their cost and price received.

One machine making 150 hollow blocks daily takes 11 tons of sand, at $1.00, $11; 13 barrels cement, at $1.00, $13; fixed charges and labor, $20; hauling, $5; incidentals, $2; total, $51. Price received delivered on work, 50 cents each, $75; total profit per day, $24. These blocks measure 32 in. by 9-in. face and 12 in. deep, and weigh about 130 lb. each. If such a plant had double the output, there should be a saving of 5 cents per block.

Blocks 32 in. long, 10 in. wide and 9 in. high are very much in demand, as they will displace 42 common brick in a wall. For comparison, Mr. Matcham assumes that common brick cost $12.50 per thousand in the wall. If one of these blocks will displace 42 brick, 24 of them will be equivalent to 1,008 brick in the wall. If one of these blocks cost 20 cents, 24 of them will cost $4.80. If it costs 5 cents each to lay them, 24 will cost $1.20. This added to $4.80 would make a total cost for 24 blocks in the wall, which would displace 1,008 brick, exactly $6.00. Allowing for hauling and fixed charges, there is sufficient margin left between the cost of concrete blocks and common brick for a handsome profit.



Entrance to Concrete House and One of the Interior Details.

Sand and cement brick, made by machinery, can also be produced at a cost of $6.00 or $7.00 per thousand, the mixture being about one part cement to three and one-half parts sand. These bricks are as neat in appearance and serviceable as pressed brick, and are selling for about $18.00 per thousand, f. o. b. cars.

Cement blocks are made in different manner; some blocks are made by mixing one part cement to five or six parts sand or crushed stone, the proportions of sand and stone to cement depending largely on the quality of each. Experimental tests will soon show the best proportions of each.

The mortar is mixed reasonably dry and then well tamped, usually by an iron rammer. There is another method for making concrete blocks, mouldings, etc., and that is by having a wetter mixture and pouring the concrete into the mould. By this method there is less liability for voids, the blocks are denser and less liable for moisture to penetrate. All kinds of artistic work, such as columns, mouldings, urns, window sills, cappings, balustrading, etc., can be made by either method; the wet system is perhaps preferable in some cases, although it requires more care and study than by the dry method.

The making of window sills, capping, columns, etc., requires a pattern maker for making the moulds. This is a small item of additional expense and can always be taken into consideration when estimating. The cost of turning out such work enables the manufacturer to turn out goods equal to cut stone and for far less money.

Reinforced Concrete.—The ability to secure concrete of such a character as is necessary for the best form of construction, by ordinary methods of workmanship in the hands of commonly conscientious and experienced foremen, has been demonstrated beyond a question; but naturally certain conditions must be observed to secure this work and the combined action of the steel and concrete. The steel must be free from loose scale and oil. The concrete must be closely incorporated about the steel; the best practice to effect this is to use concrete of a plastic rather than of dry or granular consistency, as the plastic concrete will reach the smallest interstices of the steel and forms by puddling more intimately than dry concrete; furthermore, it makes a more impervious concrete with which to protect the steel. The loss of strength in its early age due to making a concrete plastic, is more than allowed for in the limit of stresses permitted, and tests of one year or more have demonstrated that it regains this loss in time.

To show the action of concrete and steel under various conditions of weather, Mr. Matcham had made up in January, 1902, a number of 6-in. cubes. In some of these there were imbedded pieces of steel, some with the iron painted and some without. Some of each were set out in the open air exposed to both summer and winter weather, and at times these blocks were covered with snow and ice. Some of the blocks were set in the bottom of a river. These he has watched from time to time to see if they were still there, or whether they had disintegrated, or the water had washed them out of existence. Recently he sent two of these cubes from the open air and one from the river to the Spackman Engineering Co., and their report is as follows:

"We report the tests on three 6x6x6-in. concrete cubes, made of one part cement, two parts sand, and five parts crushed stone, and containing a 3x3x3-in. block of steel in the center.

"No. 1. Made Feb. 1, 1902; 3-in. steel cube painted with metallic paint; failed at 104,660 lb. = 2,907 lb. per sq. in. of surface.

"No. 2. Made Jan. 3, 1902; with 3-in. steel cube not painted; did not fail at 150,000 lb. = withstood 4,166 lb. per sq. in.

"No. 3. Made Jan. 3, 1902; with 3-in. steel cube not painted; failed at 105,140 lb. = 2,920 lb. per sq. in."

No. 1 was the cube taken from river, and the water had no effect whatever on the steel. This block of steel was originally painted, which has now partly disappeared; the concrete, however, shows that some of the paint had stuck to the concrete.

No. 2 for some reason withstood more than the testing machine was good for. It was broken by hand. The steel piece taken from this cube hardly shows a blemish, and is as good as when first put in the cube.

No. 3 failed at 105,140 lb., and also shows the steel to be as bright as when set in the cube.

Considering these cubes were three years old, they are good examples of the durability of concrete and steel for construction. Mr. Matcham has more of these cubes to break at five and ten years, some painted, and some unpainted, and exposed to weather and water.

A Concrete House.—Last year Mr. Matcham built for himself a concrete house which, including porches, has a frontage of 58 ft., and 55 ft. depth. In starting foundations, they are made 15 in. in width for about one foot, or cellar floor level; from the cellar to roof, 13 in., the concrete mixture being one part cement, four parts sand and seven parts stone. The window and door frames were set as the concrete progressed. The hall floors, 16x35 and 8x15 ft., are of concrete and expanded metal; the floor is 5 in. thick laid on 12 in. by 17-ft. beams, set 8 ft. apart. These concrete floors were finished off with cement and tile bordering. The porches are also of concrete and expanded metal resting on an offset in the concrete walls, with cement and tile finish. The porch roofs are of a clear span of 12 ft., made of concrete and expanded metal.

This expanded metal was of 2-in. mesh, 1/8 in. thick. It was laid on the boards set to hold the concrete. To this expanded metal was fastened some small channels 1 in. deep and 2 ft. apart. The concrete was then laid and tamped into the meshes and around channels and made 4 in. thick.

The walls and arches are reinforced with iron rods, the walls having 1/4 in. rods set vertically and horizontally about 18 in. apart, and over the windows and porch openings 1/2-in. rods are laid in the concrete.

The columns and urns, as here shown, were cast in concrete in an ordinary wood mould, and finished off with the house; that is, all the rough concrete after framing was removed, received a rough coat of cement and sand plaster, proportions one to four. This gave an even surface and could have been considered the outside finish, but in order to have a light buff finish, a second coat of lime and yellow sand was put on very thin, proportions being one part lime to four parts sand.

In doing the work over again, Mr. Matcham would only apply one coat composed of one part cement, one part lime, and five or six parts of white or yellow sand. The mouldings on the columns were finished by applying the coating of lime and sand with a brush. The adhesion of the coating to the concrete has made a perfect bond.

A house with the natural concrete finish, evenly roughed off, would make a neat finish, and, of course, be cheaper, but not as warm in appearance as the buff sand finish of this house.

The fireplace in the billiard room is made of ordinary red clay brick and gray cement brick, the mantle being moulded in one piece, cast out of sand and cement. The fireplace in the dining-room (see cut) is of sand and cement brick, and moulded mantle.

Much has been said as to the feasibility of plastering on solid walls without using lathing, there being doubt about moisture coming through the walls and plaster. Moisture will not penetrate a solid wall if a reasonably wet concrete is used; a dry concrete Mr. Matcham cannot vouch for, and water may penetrate it, although this is doubtful.

Claims are made that the different temperatures between the inside and outside of walls, particularly in winter time, cause sweating. Mr. Matcham denies this on the ground of experience with various kinds of buildings, all having varying temperatures; all have shown perfect dryness inside, irrespective of temperatures and weather.

As to the cost of construction, there were 400 cu. yd. of concrete in the walls and floors of the house, and taking into consideration the carpenter work, setting up framing, setting doors and window frames, and joists as the work progressed, the common labor, cement, sand and stone, totaled up to $2,600, which would make the concrete cost $6.50 per yard. Ordinary brick houses, with pressed brick face, cost from $10 to $12 per cubic yard.

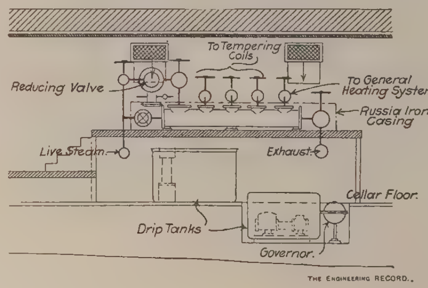
In considering the cubic yards of concrete in this house, the hall and porch floors and roofs are figured in. If these had been figured separately, the main walls of the house would cost less per cubic yard, and, of course, the floors and roofs more, and it must further be taken into consideration no further carpentering was needed for roofing or flooring or slaters and painters, as would be necessary for a brick building. The cost of repairs to such a house are also brought down to a minimum.

The following material was used to a cubic yard of concrete; 320 lb. of cement, 950 lb. of sand, 2,560 lb. of crushed stone, 290 lb. of water; total, 4,120 lb. The proportions were about one part cement, three parts sand, and eight parts stone.

LIGHTNING ARRESTERS WITH TELL-TALE PAPERS was the subject of an article by Mr. N. J. Neall in a recent issue of the "Electric Club Journal." Lightweight bond papers of uniform texture should be used, he says, and they should be inserted in the gaps to be investigated and so shaped as to make it impossible for a discharge to pass without puncturing them. Each arrester on the system should have several of these papers, carefully dated, marked with the location on the line and of sufficient size for any remarks as to the particular events registered thereon by a static discharge. The papers should be removed regularly from the gaps, except in time of disturbances. when they should be removed immediately after the storm. A file of the returns is to be kept so that the operator of the plant can collate information from them as to the behavior of the line as a whole.

Heating, Ventilating and Air Cooling at the New York Stock Exchange.—II.

Heating.—The heating of the building is accomplished almost altogether by direct radiation, as the fan equipment is only for circulating tempered air for ventilation; but the heating plant is of considerable interest, owing to the extensive use of enclosures for hiding the radiation and in respect to the calculations for the large board room with its proportionally large amount of glass surface. Exhaust steam from the mechanical plant is utilized in the usual way, and the radiation is connected on a two-pipe system with the supply and return mains distributing mostly in the cellar; the Paul system of extracting the air from the radiators by air lines from the radiator air valves to steam jet exhausters has been applied, and the radiation is controlled by the Johnson system of automatic temperature regulation. The only rooms warmed by the air supply are those which, on account of certain architectural considerations, made direct radiation impracticable, and the branch ducts from the ventilating system for these rooms are fitted with indirect surface supplementary to the tempering coils.



Elevation of Distributing Drum.

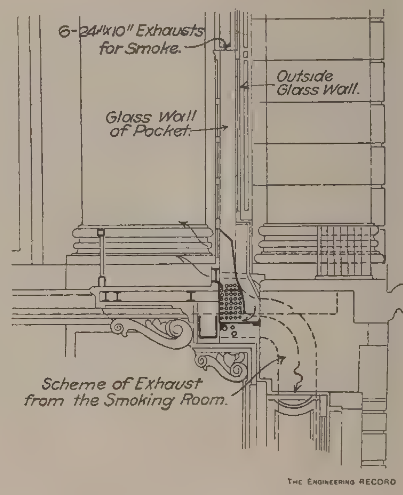
The supply of low-pressure steam for heating is controlled from a distributing drum, which is now not an unusual feature in the mechanical plant of the large building, for the convenient arrangement of connections between the different heating mains and the source of steam supply, both the exhaust and the auxiliary reduced-pressure live steam. The exhaust main from the electric-generating plant, 12 in. in size, is joined by an 8-in. main from the rest of the steam machinery of the plant, and the exhaust, in a pipe 14 in. in diameter from the point of junction, is led successively into a muffler tank and the feed-water heater. Beyond the heater the pipe is continued full size to the distributing drum with a 12-in. branch with Kieley back-pressure valve opening into the free exhaust riser to the atmosphere.

The muffler tank is 48 in. in diameter and 7 ft. high, located at one end of the boiler room, and is of the Potter type, with 24 galvanized-wire disks to serve as an oil separator. The feed-water heater was furnished by I. B. Davis & Son, of Hartford, and is of the Berryman vertical pattern, 45 in. in diameter and 121 in. high, containing about 250 sq. ft. of heating surface of 2-in. brass tubing. It has, of course, a by-pass.

The distributing drum is of cast iron, 14 in. in inside diameter, with a flanged outlet at each end and a series of them on the top. To one end is brought the 14-in. exhaust connection, and to the other a 6 in. live steam connection. Ordinarily, however, the auxiliary live-steam supply is received at reduced pressure through an 8 to 14-in. Kieley reducing valve, which delivers into the drum through one of the top openings, the 6-in. pipe being a by-pass around the reducing valve. Three steam lines are taken to the three groups of tempering coils of the ventilating system, two 7 in. in diameter and the other, for the board room, 8-in. in diameter, and an 8-in. line serves the direct heating and the incidental supplementary indirect surface mentioned.

Altogether there are 8,170 sq. ft. of tempering coil surface, about 13,000 sq. ft. of direct radiation and about 500 sq. ft. of supplementary heating surface. The condensation from each of the three tempering coils is separately handled by a 7¼x4½x6-in. Blake duplex pump, operated under the control of a Kieley pump governor, and there are three other pumps of the same size, similarly controlled. One of the latter is regularly employed to handle the condensation collected in a high-pressure drip tank. The other two act as boiler-feed pumps with the suction connected to the system of direct radiation return pipes, which are kept submerged by the level maintained by the pump governors. All of these pumps are arranged to deliver into the boiler feed mains. Make-up water is received from the city mains and passed through coils for cooling the contents of the blow-off and low-pressure drip tanks, the latter receiving grease laden water which must be cooled before it is pumped to the sewer.

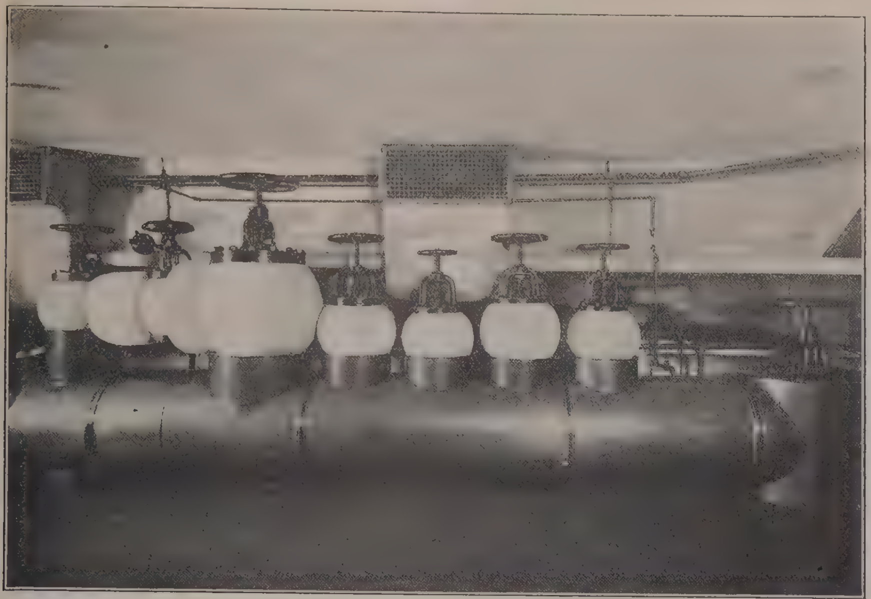
The amount of radiating surface to be installed is determined on the lines usually followed by Mr. Wolff. The hourly heat losses for the bounding surfaces of each room are calculated for 70° indoors and zero outdoors, with allowance for exposure, and the number of square feet of radiation is ascertained on the basis of 250 B. t. u. supplied per hour per square foot of direct radiator. In the Stock Exchange building, however, some of the conditions are of a special character, as explained.


6-24"x10" Exhausts for Smoke.
Outside Glass Wall.
Glass Wall of Pocket.
Scheme of Exhaust from the Smoking Room.
THE ENGINEERING RECORD

Glass Wall Pocket at Gallery Floor.

The board room is 110x139 ft. in plan and 78 ft. high, and the east and west walls are very largely of glass, each having an expanse of 92x51 ft. unbroken save for the structural steel framework supporting it. The north and south walls are within the building, and no transmission of heat through them is considered. An accompanying table shows the total values for the different classes of exposed wall in this room. The coefficients in each case are, of course, the number of British thermal units transmitted per square foot per hour for the 70° range. For exposure the east wall transmission figures are increased by 30 per cent., the west wall figures by 35 per cent., and the skylight figure by 10 per cent. The total amount of the hourly heat transmission to be overcome by the direct radiation is 1,264,000 B. t. u., so that at the given rate of 250 B. t. u. per square foot per hour, 5,000 sq. ft. of radiation are apparently required.

Under the severe weather conditions for which the apparatus is proportioned, however, the air for ventilation can be delivered into the room



Steam Distributing Drum from which Entire Heating Plant is Controlled.

somewhat above 70°, and in that way assist the direct radiation in making good the heat losses through the walls. As a matter of fact, 3,960 sq. ft. of direct radiation are installed, and at the given rate of 250 B. t. u. per square foot will furnish 990,000 B. t. u. per hour. The remainder of the heat can be obtained by allowing the air introduced at the ceiling to cool 4°, say, from 74° to 70°, before reaching the occupants of the room, the volume being about 60,000 cu. ft. per minute. On the basis of the radiation required the ratio of contents to the heating surface is 240 cu. ft. to 1 sq. ft., while the amount actually installed gives a greater ratio owing to the dependence, under extreme conditions, on the ventilating plant to supply approximately one-third the heat.

Hourly Heat Transmission, Board Room.

	Sq. ft.	Exposure factor.	B.t.u.
Window surface, coefficient, 85.			
East wall	5,015	0.30	555,000
West wall	4,840	0.35	555,000
Outside wall, coefficient, 5.			
East wall	3,681	0.30	24,000
West wall	3,688	0.35	25,000
Doors, coefficient, 100.			
West wall	168	0.35	22,700
Skylight, single, coefficient, 73.			
Ceiling	1,024	0.10	82,500
Total			1,264,200

The radiation is arranged along the two glass walls, part at the main floor line and part at the gallery level, which is 18 ft. above it. Practically all of it is of the enclosed type, with openings for circulating the air, except four coils, each of 150 sq. ft. of surface, for the skylight over the center of the room. The unobstructed glass walls start upward from the galleries and the radiation at that level is entirely to offset the losses through these walls. It is grouped in seven coils of 200 sq. ft. of surface in each case. The descending sheets of cooled air, as they approach the gallery, fall into a space formed by a double glass wall, and this glass pocket leads to a level below each steam coil where the air passes upward, is heated by the coil, issues into the room through registers at the gallery floor, rises on the inner side of the descending currents of air, and as it reaches the upper points, giving up its heat, joins the descending currents and thus completes a circulation of air. The object of this circulation is, of course, to supply the heat which must be provided to prevent drafts and undue cooling otherwise likely to occur with the large area of the glass. The glass pockets are about 10 in. deep, the inner glass wall, which rises 12 ft. above the gallery floor, being placed about that distance from the main glass wall.

The radiation is all controlled by thermostats, as stated. The coil surface for the large windows of the board room is, however, divided into two parts in each case. Three-sevenths of it is put under steam when the outside temperature drops to a predetermined temperature, and the remainder is controlled by thermostats indoors. One outdoor thermostat, set for 45°, controls all the three-sevenths sections of the Broad St. window coils, and, similarly, one thermostat controls the smaller divisions of the New St. coils. The larger divisions of the coils are controlled by three thermomstats in the case of each window, two for two coils each and one for three coils.

Gallery in Board Room Showing Air Pockets for Air Circulation.

In applying the coefficients of heat transmission, the usual values were taken for windows and skylights, but for doors, owing to the avenue they offer for the escape of heated air, 100 B. t. u. were counted on per square foot per hour of the door area. The walls were regarded as equivalent to brickwork of the actual thicknesses, but for the larger walls, 54 in., 66 in. and 84 in., the coefficient was taken at 5 for all three. In a few of the rooms of sub-basement No. 1, a coefficient for the outside wall of 3 B. t. u. was taken, but the fact that moist earth surrounds the building and that the transmitting power of the concrete cofferdam, which constitutes the retaining walls, is unknown under the conditions, led to installing quite a little more radiation than given by the calculations. Another special case was a stairway located alongside the fresh air inlet shaft. Here double the regular values for transmitting coefficients for the outside wall of each thickness were employed, and the window surface was charged with 100 B. t. u. per square foot per hour. Practically no direct radiation was placed in sub-basement No. 2.

The contractors for the heating and ventilating installation were Messrs. Baker, Smith & Co.

(To be continued.)

The Reinforced Concrete Pugh Power Building, Cincinnati.

The 68x335-ft. Pugh Power Building, now in course of construction at Pike and Fourth Sts., Cincinnati, is built entirely of reinforced concrete, and will be used for manufacturing purposes. Owing to a difference in elevation of 45 ft. at the opposite ends of the site, it will have 10 stories at one end and 7 stories and a basement at the other, with a height of 159 ft. and 129 ft. respectively, above the foundations. Part of the ground in the foundation was very compact gravel and showed no settlement under test loadings of 6 tons per square foot, while part of it consisted of sand, which showed some settlement under a load of 4 tons. Loads of 5 tons and 3 tons per square foot were allowed on the different foundations, and necessitated footings up to 11 ft. square.

On account of the slope of the ground, a number of retaining walls were required, and these were made from 4 in. to 6 in. thick and reinforced by ½-in. steel rods in both directions and by stiffening girders of various sections, assumption being made that the thrust of the ground is transmitted partly to the columns, stiffening girders, floors and partly to the ground. In many cases these walls were from 8 to 18 ft. deep, and as the area of the building is relatively small as compared with its length, the percentage of basement area saved by them is considerable. The outside of these retaining walls was given a coat of Toch Bros.' waterproof paint to prevent the penetration of moisture. The columns which support the floors are spaced from 14 to 17 ft. longitudinally, and from 20 to 23 ft. transversely. The floors are designed for a total load of 230 lb. per square foot. The lowest tiers of columns had to carry loads of from 500,000 to 700,000 lb. each, and were made 24 in. to 26 in. square, reinforced by eight to twelve 1¾-in. rods. The column rods were generally continuous for two stories, and were spliced by gas pipes ½ in. larger in diameter than the rods and 2 ft. 6 in. long. The rods were held together by horizontal ties spaced 16 in. on centers, and the size of the columns and rods diminished from story to story.

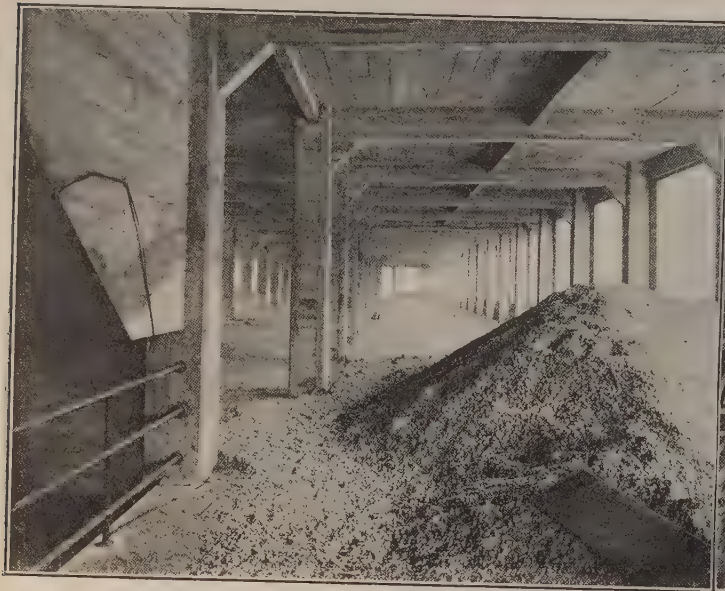
The building being considerably higher than wide, provision had to be made for wind bracing. To accomplish this the main girders in each floor were arranged crosswise, and are connected by large brackets to the columns and reinforced by a separate system of rods in the brackets and the tops of the beams. The general arrangement of girders and beams can be seen from the illustrations. The floors were reinforced by ⅜-in. rods, spaced from 3 in. to 12 in. apart in both directions, and were made 5¼ in. thick, 4½ in. of rough concrete and ¾ in. of cement finish.

The outside walls in the building are also built of reinforced concrete. The window openings take up 50 per cent. of the area of the walls, the latter consisting mostly of pilasters, spandrel girders and 4-in. parapet walls. The Pike St. front is made 12 to 24 in. thick for architectural effect, and will be faced with blocks of Rockcastle stone, which very closely resembles finished concrete. The stones are held by flat anchors imbedded in the concrete and spaced 18 in. vertically and 3 ft. horizontally.

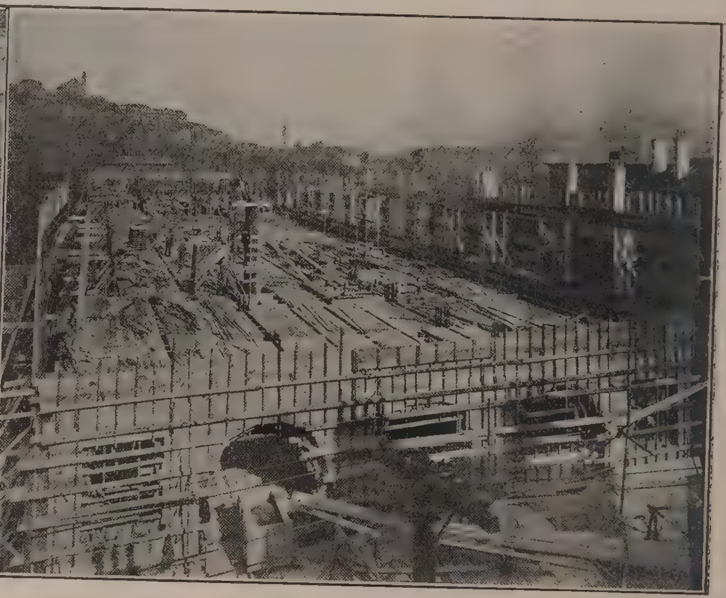
All staircases in this building are of reinforced concrete, some of them being suspended. All partitions, as well as the two hot-air and ventilating shafts, are of reinforced concrete, 4 in. thick. The sidewalk on Pike St. is also of reinforced concrete, as well as the frames of the prism lights.

In the basement is an underground duct 7 ft. wide and 7 ft. deep, covered by a reinforced concrete floor. The thickness of the sides and bottom of this duct is 6 in.

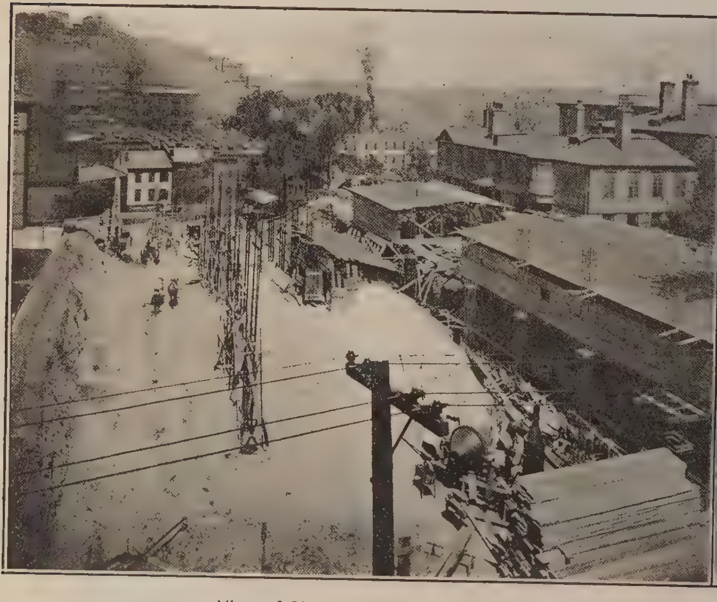
The building being for manufacturing purposes, two 150-h.-p. Westinghouse steam turbines will



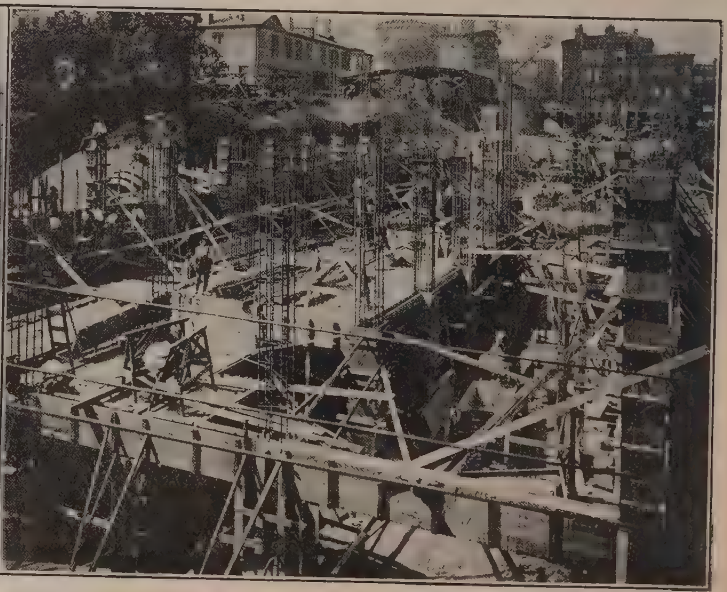
View on Third Floor from West to East.



View from the Northwest.



View of Site from Northwest.



View from the Northeast.

be installed in the boiler and engine room at one end of the basement. A reinforced concrete chimney, 6 ft. in diameter and 167 ft. high, will furnish the necessary draft for the furnaces.

It is expected that the grade of one of the streets will be raised 12 ft., and a railroad siding built into the building, to serve the elevators and coal chutes. The first floor girders were built heavy enough to sustain axle loads of 25 tons, with a factor of safety of at least 6, and the intermediate floorbeams were spaced 5 ft. just beneath the location of the future rails. Part of the first floor is 4 ft. higher than the space provided for the siding, and forms a conveniently located shipping platform. The height of the first story being 18 ft., permits the entrance of the largest cars.

View of the Pugh Power Building, Showing Extent of Window Area.

The illustrations give an idea of the manner in which construction was carried on. One of the most difficult parts of reinforced concrete work is the preparation and erection of the centering. Before beginning the work, sheds about 200 ft. long and 40 ft. wide were erected at the south side of the building and electrically driven woodworking machines installed. Exact structural plans for the centering were prepared and an attempt was made to carry out the centering with the speed and exactness followed in structural steel work. The result was that construction work was carried on in the last few months at a rate of 16 days to a complete story, the area of the building being 22,000 sq. ft.

The reinforcement used was medium steel rods of round section. As all the rods had hooks at the ends and nearly half the number were bent into hog chain forms, special machinery was installed to do the bending, which was done cold for sizes under 1 in., electrically driven forges being used to heat the larger rods.

All the concrete used was mixed wet in the proportion of one part cement to two parts sand and four parts crushed boulders. Two Smith mixers were placed, one near each end of the building, and in front of them were erected self-dumping, ¾-yd. bucket elevators. The concrete was deposited into a bin on each floor and emptied into wheelbarrows through a sliding door in the bin. Only one mixer and one hoisting bucket were used at a time.

About 8,000 cu. yd. of concrete and 800 tons of steel will be used in the building. The centering required about 1,000,000 ft. of lumber, caused by the rapid progress of the work.

The cost of the building complete is about $225,000. The owner, Mr. A. H. Pugh, decided on a concrete building and instructed his architects, Messrs. Dittoe & Wisenall, Blymyer Bldg., Cincinnati, to prepare general drawings and specifications. Bids were invited, with the stipulation that within 10 days of the acceptance of the bid a complete schedule of the design of girders, columns and floors be furnished. The bids received varied over 100 per cent. The best bid received was by Mr. L. J. Mensch, civil engineer and contractor, Monon Bldg., Chicago, and the work was carried out by Messrs. A. Bentley & Sons, of Toledo, Ohio.

The building will be equipped with a complete system of heating and ventilation, installed by The American Blower Co. The system consists of a large blower located in the first story which draws air through coke screens and running water and forces the cleaned air through underground ducts in each direction to vertical heating shafts. A central partition in these vertical shafts is built on an incline, one side being used for the admission of the heated air, and the other side for the discharge of the vitiated air. It is believed that clean heated air may be utilized and distributed through the building in sufficient quantities so that the windows may remain closed under all circumstances, both winter and summer, as arrangements will be made for cooling the air in summer.

The building will be equipped with a complete plumbing system, including filtered ice water delivered to both office and factory portions on each floor.

The windows will consist of hollow sheet metal frames glazed with wire-ribbed glass and manufactured by the W. H. Mullins Co., of Salem, Ohio. These windows are equipped with locks on each sash, and are arranged to be pivoted in the factory portion and with box frames in the office portion.

There will be two passenger and two freight high-speed electric elevators. All doors throughout the building are made with wooden cores, covered with asbestos and sheet metal, the glass panels being glazed with wire-ribbed glass. The building will be equipped with a complete system of automatic sprinklers. The various floors have been rented to manufacturers of Cincinnati, and possession of the building is guaranteed on or before July 1.

Difficult Sewer Tunneling at Sydney, N. S. W.

The main sewer of one of the drainage districts of Sydney is an egg-shaped section, 3 ft. 3 in. high and 2 ft. 2 in. wide inside. The invert and sides are concrete with a single ring of brickwork, and the arch has two rings of brickwork. Double-pressed radial brick laid in 1:2 Portland cement mortar are used. The sewer is in a tunnel, and the original contractor for the work found it so difficult, owing to the presence of water, that he gave it up, and the construction was carried on by day labor. It was under the charge of Mr. L. A. B. Wade, from whose report the following notes have been taken:

The sides and roof of drive were close-timbered with 2-in. hardwood, and where the ground was exceptionally bad a floor of the same material was provided. Sets of timber were placed at 4 ft. intervals, the legs being notched into top and bottom sills; poling boards were driven closely together, and any crevices were packed with straw to prevent sand from filtering into the drive. The settlement of the timber was unequal, and the legs of the sets had to be cut of such length that when the bottom sill had come to rest the necessary height of the drive was maintained. The face of the drive was close-timbered, to allow of each set or frame being placed in position. The face boards were in two parts, attached to a clamping board, which were slotted to permit of the boards being extended. The face boards were forced past the ends of the side poling boards, which held them in position.

Two heavy timbers, running on cross-pieces spiked to the legs, carried the cap under the projecting roof boards as they were driven forward, and the side boards were driven in, the top ones leading, until the position of the next set was reached, when the face boards were put in, working from the face downward. Straw was packed at the back of the face boards, and was freely made use of wherever there was any liability of the sand filtering through. Three shifts of miners were engaged, two working at each face; the work proceeding continuously for the six days of the week, and the average length driven and timbered in each drive being 25 ft.

A large flow of water was constantly passing down the drive, and pumping was almost continuous; duplex steam reciprocating pumps being used.

Quick-setting cement was provided for the concrete and brickwork, and it was often a difficult matter to keep the water pressure from the work until it had time to set. Where boils in the sand were met, lead pipes were built in the concrete or brickwork, and the water was flumed over the new work; packing was afterwards driven into the pipes, and cement mortar was filled in over the packing. On the completion of the brickwork and concrete the space between them and the timbering was packed with sand.

The average depth of the sewer below the surface was 24 ft., and shafts were sunk at intervals of 215 ft.; every alternate shaft being built up in brickwork, and the intermediate shafts filled in.

A Searchlight 11,225 ft. above sea level is to placed on Mt. Hood, Washington, according to Mr. F. L. Merrick, in the "Journal of Electricity, Power and Gas," in connection with the Lewis & Clark Exposition, capable of throwing a beam 200 miles and illuminating neighboring peaks.

Diagram for Power Pipes.

The accompanying diagram was prepared to facilitate the determination of the maximum horse-power obtainable from water under different heads flowing through pipes of different diameters. It also shows the quantity and velocity of the discharge. The horse-power is taken equal to a constant multiplied by the water discharge, multiplied by the pressure head, or horse-power $= kQp$. The formula, $V = \sqrt{RS}$, is used for the velocity. A constant diameter and a constant length of pipe are assumed for any particular case; so S varies as the head, and the value of the velocity may be obtained from the equation, $V = d\sqrt{h}$, where d is a constant and h is the head overcoming friction and causing discharge. The quantity discharged in any particular case equals the velocity multiplied by a constant, that is, $Q = a\sqrt{h}$, a including d, and the cross-sectional area of the pipe.

Substituting this value in the assumed equation for the horse-power, horse-power $= kap\sqrt{h}$. The pressure head equals the static head less the head causing discharge, or $p = H - h$, and a single constant, b, may be substituted for a and k. Then the horse-power $= b\,(H\sqrt{h} - \sqrt{h^3})$. Differentiating this equation with regard to the variable h and considering the first differential function equal to zero, the condition for maximum horse-power is obtained. From this it is found $h = H \div 3$, that is, the maximum horse-power is obtained when the discharge is regulated so that the head causing discharge or absorbed in overcoming friction is one-third the static head.

The computations on which the diagram is based were made by assuming given diameters of pipe and lengths of 1,000 ft., with coefficients obtained from Kutter's formula. Taking the above condition for maximum horse-power, $h = H \div 3$, and substituting this value of h in the equation from which it was derived, the horse-power $= K\sqrt{H^3}$, where K is a constant. This shows that the maximum horse-power varies as the head raised to the $^3/_2$ power, when the diameter and length of pipe remain constant.

The curves platted with lightly dotted lines show the quantity of water used; for example, given a 60-ft. head and an 18-in. pipe to find the discharge. A horizontal line drawn through the 60-ft. head intersects the 18-in. pipe curve very close to the 15-cu.-ft.-per-second line, so the quantity of discharge for these conditions is, from the diagram, a little more than 15 cu. ft. per second. The curves for the different size pipes are in the form, $x = k\sqrt{y^3}$. To illustrate the use of the diagram for obtaining the size of pipe to be used to produce maximum horse-power with a given head and length of pipe, assume 114 ft. as the available head 45 cu. ft. per second as the minimum flow and 1,600 ft. as the length of pipe. A horizontal line through the 114-ft.-head line intersects the 24-in.-pipe line at about 44 cu. ft., and the given head with a length of 1,000 ft. of pipe of that size under these conditions will, according to the diagram, produce 380 h.p. Since the velocity, and hence the maximum horse-power, varies inversely as the square root of the length of the pipe when the head of water and the diameter of pipe are constant, for a 1,600-ft. pipe the horse-power would be $380 \div \sqrt{1.6} = 302$ h.p. From the diagram the velocity of discharge will be about 14 ft. per second for the same conditions.

The computations were made and the curves of the diagram were platted as thesis work by Mr. W. P. Tams, under the direction of Prof. L. S. Randolph, professor of mechanical engineering in the Virginia Polytechnic Institute.

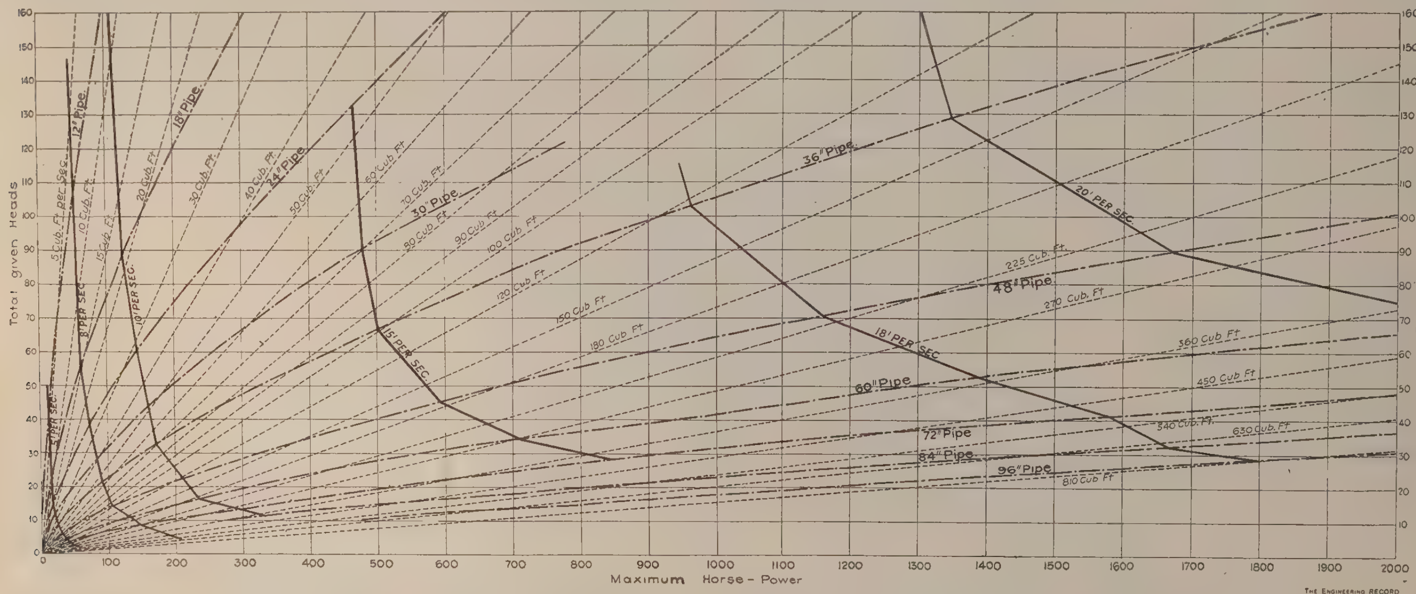


Diagram of the Maximum Horse-Power Obtainable from Water under Different Heads in Pipes of Different Sizes.

Experiments with Treated Cross-Ties in Texas.

The most troublesome feature of service tests of the length of life of cross-ties is the time required to secure definite results. While untreated ties have a life of only 5 to 10 years, treated ties may be in use for double that period before definite results are obtained. When the Bureau of Plant Industry undertook a series of tests of this nature it sought at the outset for some means of reducing this time. The deterioration which takes place in timbers treated with tar oil or metallic salts consists either in the leaching out of the salts soluble in water or in the volatilization of hydrocarbon compounds. These changes are favored by excessive moisture and excessive heat. Heat and moisture likewise promote the growth and development of timber-destroying fungi in untreated wood. It was thought, therefore, that by selecting a region where there would be long periods of high temperature and heavy rainfall it might be possible to hasten the deteriorating changes in the treated timbers, and at the same time to accelerate the activity of the decay-producing factors in the untreated wood.

After considerable investigation a region in southeastern Texas was selected for the test. In this region the average temperature for July and August is about 94°, and the average rainfall for the months of June, July and August is about 14 in. In this region the average length of life of untreated loblolly pine ties is about one to two years. Fungi of all kinds grow with enormous rapidity, favored by the humid condition of the atmosphere and the soil.

The tests were made on railroad ties because wood in this form is exposed to decay-producing influence at all times, since the position of a tie in the ground, partially surrounded by soil, prevents the evaporation of water and correspondinly promotes the development of the destructive fungi, and because salts or tar-oil products are apt to escape more rapidly from a tie than from any other form of wood. From a very interesting report on the condition of the ties in November, 1903, by Dr. Hermann von Shrenk, the following notes are taken:

During the summer and fall of 1901 preparations were made for a test on the Beaumont division of the Gulf, Colorado & Santa Fe Ry. Treated and untreated timbers from various parts of the United States were contributed by railroad companies, and were treated without charge by preserving companies. They were shipped to Somerville, Tex., where they were provided with dating nails and nails indicating the kinds of timber. All were then sent eastward from Somerville and laid in a continuous stretch of track about 2.5 miles long. They began to arrive at Somerville during the fall of 1901, and were laid during February, March, April and May, 1902.

The timbers submitted had to be treated at various preserving plants, under the supervision of the persons operating these plants. It is to be regretted that, owing to the conditions under which this first test had to be made, it was in most cases not possible to treat the ties exactly as they would have been treated in the course of regular commercial operations. It is likewise to be regretted that the timbers were not always of the best quality. In certain instances the test ties were made parts of regular runs, and so received exactly the same treatment as was being given to ties for ordinary use by various railroad companies. In certain other instances the various kinds of timber were lumped together, because they were too few to be treated separately, and as a result it is probable that some of the timbers did not receive the best treatment.

The experimental track was completed in May, 1902. All ties of one kind of timber were laid together—for example in the case of white oak the order was, white oak Burnettized, white oak Allardyce, white oak untreated, white oak Wellhouse, etc. In this way approximately the same conditions were obtained for the same timbers.

The traffic over the track is mostly in a westbound direction. For the past year the gross tonnage passing over the Beaumont division amounted to 306,000,000 tons, equivalent to about 2,000,000 tons per mile during the year, or 166,000 tons per month. The maximum wheel load per axle of locomotive passing over the track was about 35,000 lb.

A careful inspection of the experimental track was made on Nov. 30, 1903. Each tie was examined, and notes were made as to the extent to which the ties had worn, checked or decayed. The general condition of the track was good. Most of the ties had worn very little, and with the exception of one species of timber they had not cracked to any extent. Almost all of the untreated timbers showed signs of decay, some more and some less, which indicated that the selection of this part of the country for the purpose of getting rapid comparative results was a good one.

Of the treated timbers, those treated with the Hasselmann (or Barschall) process showed some signs of decay. These were ties included in a run which was stated not to have received the proper treatment.

A certain number of ties, which had been treated by the zinc creosote process at Beaumont, Tex., but which had been subjected to an excessive heating during the treatment, had to be removed very soon after being placed. They were brittle when they arrived, and should not be considered as furnishing a fair test of the process. These ties have shown what is probably the most interesting result so far obtained from the test. The oak ties which were submitted to the overheated treatment were soft and exceedingly brittle when they reached the place where they were to be laid. A number of them were broken when thrown from the cars. The remainder, both those which have been removed and those which are now ready to be removed from the track, have all been broken and shattered, indicating that during the process of treating the strength of the timber had been materially affected.

The following is a detailed statement of the number and condition of the various ties in the experimental track at the time of inspection. The fungi found growing on some of the ties are species found generally over the United States.

Beech, untreated.—Of the 87 untreated sawed beech ties laid, 38 had fungi on them. Of these fungi the most common is the grayish white fungus (*Polystictus versicolor* Fr.) often found on beech wood throughout the beech-growing belt. In most cases the fungi were growing with considerable vigor, and covered the entire end of the tie. The fact that fungi have attacked such a large number of ties shows that the untreated beech timber is decaying with great rapidity, and it is probable that within another year practically all of the untreated beech ties will be partially decayed. The ties have worn but little under the rail.

Beech, Wellhouse.—All of the 100 hewn ties treated by the Wellhouse process at Chicago were in excellent condition, and showed very little wear.

Beech, Burnettized.—The 99 sawed beech ties treated at Chicago with zinc chlorid were all in good condition, and showed very little wear.

Beech, Barschall.—Of the 98 sawed beech ties which received the Barschall treatment at Somerville, 20 had the grayish white fungus (*Polystictus versicolor* Fr.) growing on the ends. This indicates that they are beginning to decay. The ties show but little wear.

Beech, Allardyce.—The 50 beech ties treated at Somerville by the Allardyce process are in an excellent state of preservation, and show but little wear.

Beech, zinc creosote, overheated.—There are also 50 sawed beech ties which were treated by the zinc creosote process at Beaumont, but were subjected to an unusual degree of heat. Many of these ties were badly cracked and shattered, and many of them will have to be removed in the near future. Without doubt the extreme heat to which these ties were subjected during the treatment is the reason for their being so badly broken.

Red oak, Burnettized.—The 20 hewn red oak ties treated at Somerville with zinc chlorid were in good condition and showed very little wear. Some of them are very badly checked.

Red oak, Burnettized.—A second lot of 86 sawed 7 by 8 red oak ties, treated at Chicago, were likewise in excellent condition so far as preservation is concerned.

Red oak, untreated.—Of the 93 untreated red oak ties, 16 had the timber-destroying fungus (*Polystictus versicolor* Fr.) on them, and 23 were very badly split, probably because of unequal drying out.

Red oak, Barschall.—The 19 hewn red oak ties treated by the Barschall process were all in good condition, and showed little wear.

Red oak, Wellhouse.—All of the 20 hewn red oak ties treated by the Wellhouse process at Somerville were in good condition, and showed little wear.

Red oak, Allardyce.—The 10 hewn red oak ties treated by the Allardyce process were in a splendid state of preservation, and showed neither wear nor checking to any considerable extent.

Turkey oak, untreated.—Out of the 20 hewn turkey oak ties, 6 had the gray fungus (*Polystictus versicolor* Fr.) growing on them, indicating that they are beginning to decay. The ties are wearing well.

Turkey oak, Wellhouse.—There are 20 hewn turkey oak ties which were treated by the Wellhouse process at Somerville. Both the wear and the preservation are good.

Turkey oak, Barschall.—The 19 hewn turkey oak ties treated by the Barschall process were all in a good state of preservation, and showed little wear.

Turkey oak, Burnettized.—The 20 turkey oak ties treated at Somerville with zinc chlorid were all well preserved, and showed even less wear than most of the other oaks.

Turkey oak, zinc creosote.—Ten turkey oak ties treated at Beaumont by the zinc creosote process were overheated. These ties are considerably split, but they showed good wear and no signs of decay.

Turkey oak, Allardyce.—The 10 turkey oak ties treated by the Allardyce process at Somerville were found in excellent preservation, and showed very little wear.

Hemlock, untreated.—Of the 101 untreated hewn hemlock ties, 90 had fungi growing on the ends, in some cases to an unusual extent. Two species of fungi are growing on them—one of the common brown pine fungus (*Lenzites sepiaria*), the other the gray fungus (*Polystictus versicolor* Fr.). The very high percentage of hemlock ties with fungi is a striking indication of the comparatively poor lasting power of this class of timber. For illustrating the preserving effect of treatment hemlock will be one of the most important woods.

Hemlock, Wellhouse.—The 100 hewn hemlock ties given the Wellhouse treatment at Chicago were in an excellent state of preservation, but showed considerable wear under the rail. It should be remembered that no tie-plates were used on these ties.

Hemlock, Allardyce.—The 50 hewn hemlock ties which were treated by the Allardyce process at Somerville were sound, but showed about as much wear as the untreated ties.

Hemlock, zinc creosote.—The general condition of the 49 hemlock ties treated by the zinc creosote process, with the use of English oil, at Beaumont, Tex., was good, but they showed wear to the depth of about half an inch.

Hemlock Barschall.—Of the 100 hewn hemlock ties treated by the Barschall process, 32 ties had fungi—some a very few, others more. Four have the brown rot fungus (*Lenzites sepiaria*) and 28 a gray fungus (*Schizophyllum commune*). Most of these ties have worn well.

Hemlock, Burnettized.—The 100 hewn hemlock ties treated with zinc chlorid at Chicago showed but little wear, and were perfectly sound.

Shortleaf pine, Burnettized.—There are 100 sawed 6 by 8 shortleaf pine ties which were treated at Somerville with zinc chlorid. These were all in good condition, and showed very little wear.

Shortleaf pine, zinc creosote.—All of the 50 sawed 6 by 8 shortleaf pine ties which were treated by the zinc creosote process were found in good condition, except that one had a bad check.

Shortleaf pine, Allardyce.—There are in addition 50 shortleaf pine ties sawed 6 by 8, which were treated by the Allardyce process at Somerville. These likewise were in an excellent condition. They showed very little wear.

Shortleaf pine, Barschall.—Ninety-eight sawed 6 by 8 shortleaf pine ties were treated by the Barschall process. Their general condition was good, except that they showed considerable wear—as much as half an inch in certain cases.

Shortleaf pine, Wellhouse.—The 100 sawed 6 by 8 shortleaf pine ties treated at Somerville by the Wellhouse process were in an excellent state of preservation, and showed a maximum wear of about a quarter of an inch.

Shortleaf pine, untreated.—In the case of the 100 sawed 6 by 8 untreated shortleaf pine ties, 31 had the brown fungus (*Lenzites sepiaria*) growing on the ends, chiefly on the sapwood. The ties had worn but little.

Longleaf pine, untreated.—Of the 93 untreated longleaf pine ties, 68 had the brown fungus (*Lenzites sepiaria*) growing on them, and some are very badly decayed. This is all the more surprising in view of the fact that the longleaf pine is supposed to be a more resistant timber than the other pines. The ties showed very little wear.

Longleaf pine, Wellhouse.—All of the 100 sawed longleaf pine ties treated at Somerville by the Wellhouse process were in excellent condition, and showed very little wear.

Longleaf pine, Barschall.—There are 100 longleaf pine ties treated by the Barschall process. All were in good condition, and showed very little wear.

Longleaf pine, Allardyce.—The 50 sawed 6 by 8 longleaf pine ties treated by the Allardyce process were generally in good condition.

Longleaf pine, zinc creosote.—There are 50 longleaf pine ties treated by the zinc creosote process which were overheated. One of these was badly broken, and others showed signs of giving out. This again is an instance of the weakening of the timber by excessive heat.

Longleaf pine, Burnettized.—The 100 sawed longleaf pine ties treated at Somerville with zinc chlorid were in excellent condition, and showed very little wear.

Longleaf pine, Beaumont oil.—There are 100 hewn longleaf pine ties which were soaked in Beaumont oil. They were in good condition, and had worn as much as, but no more than, the other longleaf ties.

Longleaf pine, zinc chlorid and Beaumont oil.—One hundred longleaf pine ties were treated with zinc chlorid and subsequently with Beaumont oil. They are in good condition, and show very little wear.

Longleaf pine, spirittine.—The 100 longleaf pine ties treated with spirittine were all in excellent condition, and showed very little wear.

Loblolly pine, untreated.—Of the 100 loblolly pine ties untreated, 57 had large numbers of fruiting bodies of the brown fungus (*Lenzites sep-*

iaria) growing on the ends. The poor lasting qualities of the loblolly pine in this region are well known.

Loblolly pine, spirittine.—The 100 loblolly pine ties treated with spirittine were generally in good condition, but small fruiting organs of the gray fungus (*Schizophyllum commune*) were growing on three or four of them.

Loblolly pine, Beaumont oil.—There are 42 loblolly pine ties treated with Beaumont oil. On four of these the fruiting bodies of the brown fungus (*Lenzites sepiaria*) had appeared. The remainder were in excellent condition, and showed hardly any wear.

Loblolly pine, zinc chlorid and Beaumont oil.—Eighty ties were treated with zinc chlorid and subsequently with Beaumont oil. All of these were in excellent condition, and showed very little wear.

Loblolly pine, Burnettized.—All of the 100 loblolly pine ties treated with zinc chlorid at Somerville were in excellent condition, and showed wear not exceeding one-fourth of an inch.

Loblolly pine, Wellhouse.—The 100 loblolly pine ties treated at Somerville by the Wellhouse process were found in excellent condition, and showed no wear exceeding one-fourth of an inch.

Loblolly pine, Allardyce.—The 50 loblolly pine ties treated by the Allardyce process were in good condition, and showed little wear.

Loblolly pine, zinc creosote.—Fifty-one loblolly pine ties were treated by the zinc creosote process, using oil at a high temperature. There were no signs of decay, but many of the ties were badly worn.

Loblolly pine, Barschall.—The 99 loblolly pine ties treated by the Barschall process were generally in good condition, and showed no wear greater than a quarter of an inch. A few of them are somewhat checked.

Redheart loblolly pine, Barschall.—There are 100 sawed loblolly pine ties, which were decidedly redhearted timber, treated by the Barschall process. These were found in an excellent state of preservation, but many of them had deep cuts under the rail and several were badly split. There was no sign, however, that the decay, which started in the tree before the tie was cut, was progressing.

Tamarack, Barschall.—On the ends of 5 of the 98 tamarack ties treated by the Barschall process fungi were growing. The ties showed a medium amount of wear, in some instances as much as half an inch, but their general condition was good.

Tamarack, Allardyce.—There are 50 tamarack ties treated by the Allardyce process. They showed no signs of decay, but were considerably worn.

Tamarack, zinc creosote.—There are 51 tamarack ties treated with zinc creosote. These are part of the lot which was badly burned during the treatment. They showed considerable wear, and many of them were badly split.

Tamarack, Burnettized.—All of the 49 tamarack ties treated at Chicago with zinc chlorid were in excellent condition, although some showed considerable wear.

Tamarack, Wellhouse.—The 100 tamarack ties which were treated by the Wellhouse process at Chicago were in an excellent state of preservation, and showed less wear than the other tamarack ties.

Tamarack, untreated.—Of the 49 untreated tamarack ties, 37 had the brown fungus (*Lenzites sepiaria*) growing on the ends. A large percentage were very badly decayed. It is probable that the majority of them will have to be taken out in the course of another year.

Spanish oak, Barschall.—All of the 20 Spanish oak ties treated by the Barschall process were in excellent condition, with little indication of wear.

Spanish oak, Burnettized.—The 20 Spanish oak ties treated at Somerville with zinc chlorid were in excellent condition, and showed very little wear.

Spanish oak, Wellhouse.—There are 20 Spanish oak ties which were treated at Somerville by the Wellhouse process. All were in excellent condition, and showed very little wear.

Spanish oak, Allardyce.—The 10 Spanish oak ties treated by the Allardyce process at Somerville were in excellen condition, and showed little wear.

Spanish oak, zinc creosote.—There are 10 of these ties, which were part of the lot treated at a high temperature. Most of them are badly shattered and split.

Spanish oak, untreated.—Of the 20 untreated Spanish oak ties, 9 had fungi, which, however, do not seem to have injured the ties to any great extent. The wear is good.

Willow oak, Barschall.—The 20 willow oak ties treated by the Barschall process were in excellent condition.

Willow oak, untreated.—The 21 untreated willow oak ties were generally in excellent condition. One tie had a small fungus at one end.

Willow oak, Wellhouse.—All of the 20 willow oak ties treated at Somerville by the Wellhouse process were in excellent condition.

Willow oak, Allardyce.—The 10 willow oak ties treated by the Allardyce process at Somerville were in excellent condition.

Willow oak, zinc creosote.—There were 11 of these. They are part of the lot which was overheated in treatment. Most of them are badly shattered, and will probably have to be removed before long.

Willow oak, Burnettized.—The 20 willow oak ties treated at Somerville with zinc chlorid were in excellent condition, and showed very little wear.

White oak, Burnettized.—There are 100 white oak ties which were treated with zinc chlorid at Somerville. All of these were in excellent condition, and showed very little wear or splitting.

White oak, Burnettized.—An additional 100 white oak ties, treated with zinc chlorid at Chicao, were also in excellent condition and showed very little wear or splitting.

White oak, Allardyce.—There are 100 white oak ties which were treated by the Allardyce process at Somerville. Some of these are badly split, but none of them were decayed or badly worn under the rail.

White oak, zinc creosote.—Out of 107 of these ties, which were part of the lot excessively heated during treatment, 45 have been or are being removed, because they are so badly broken as to make the track unsafe. Those that are still in the track are badly shattered and broken, and most of them will be removed in the near future. In addition to the breaking, the rails have cut deeply into the wood. This lot of ties is certainly a striking illustration of what ought not to be done in treating timber.

White oak, untreated.—There are 196 untreated white oak ties. Twelve of these had a gray fungus on the ends (*Polystictus versicolor* Fr.) when inspected. Most of the ties were in a fair state of preservation.

White oak, Wellhouse.—All of the 100 ties of white oak treated at Somerville by the Wellhouse process at Chicago were in excellent condition, showing practically no wear.

White oak, Wellhouse.—The 100 white oak ties treated by the Wellhouse process at Chicago were in fine condition, showing no wear.

White oak, Barschall.—One hundred and ninety-six white oak ties treated by the Barschall process were laid, 7 of which have since been taken out to make room for a cattle guard. Those which remain showed very little wear, but 5 of them had fungi growing on the ends.

Black oak, Barschall.—There are 118 black oak ties which were treated by the Barschall process. Twenty-five had small fungi on the ends, and three of them were badly rotted at one en.

Black oak, Wellhouse.—The 13 black oak t treated at Somerville by the Wellhouse proce were in excellent condition, and showed lit wear.

Black oak, Wellhouse.—The 86 black oak ti treated by the Wellhouse process at Chicago we in excellent condition, and showed little wear.

Black oak, Burnettized.—The 34 black oak ti treated at Somerville with zinc chlorid were fine condition, and showed very little wear.

Black oak, Allardyce.—Most of the 60 black oa ties treated by the Allardyce process at Some ville are badly checked, but they showed very litt wear.

Black oak, zinc creosote.—There were 76 blac oak ties treated by the zinc creosote process an English oil which were part of the lot heated t a high temperature. Thirty-two of these have bee removed, because they were so badly broken a to make traffic unsafe. They have been replace with cypress ties. The remainder are badly spli and shattered, and will be removed this year.

Black oak, untreated.—The 25 untreated blac oak ties showed no signs of decay, and very littl wear.

Black oak, Wellhouse.—There are 20 black oak ties treated at Somerville by the Wellhouse process in addition to those previously mentioned, al of which were in excellent condition and showed no wear.

The experimental track had been in position for about nineteen months when the inspection herein recorded was made. Although it is as yet rather early to draw any definite conclusions, a provisional summary of the result so far indicated may be made. Dr. von Schrenk says that too much stress should not be laid on some of the results. All who make timber treatment their business must recognize that the treatment of a few ties under conditions which were not such as would be used commercially cannot justly be regarded as entirely fair to any one particular treatment. In spite of these defects in the experiment, the following results are pointed out:

(1) Practically all of the untreated timbers show more or less decay. So far hemlock, tamarack, loblolly pine, and beech have shown the least resistance, closely followed by longleaf pine. The oaks show the greatest resistance.

(2) Ties which received the zinc chlorid and the Wellhouse treatments have so far shown no signs of decay. This is true also of those treated by the Allardyce process when it was carried on in a proper manner.

(3) The results shown by some of the oaks which were subjected to extreme heat and which had to be removed on account of brittleness should serve as a warning against excessive heating of the wood, whether with dry or with steam heat.

(4) Timbers which received the spirittine treatment are generally in good condition. The small fungi which were found growing on the ends of the ties were not considered as wood-destroying fungi. They have so far not affected the soundness of the timber.

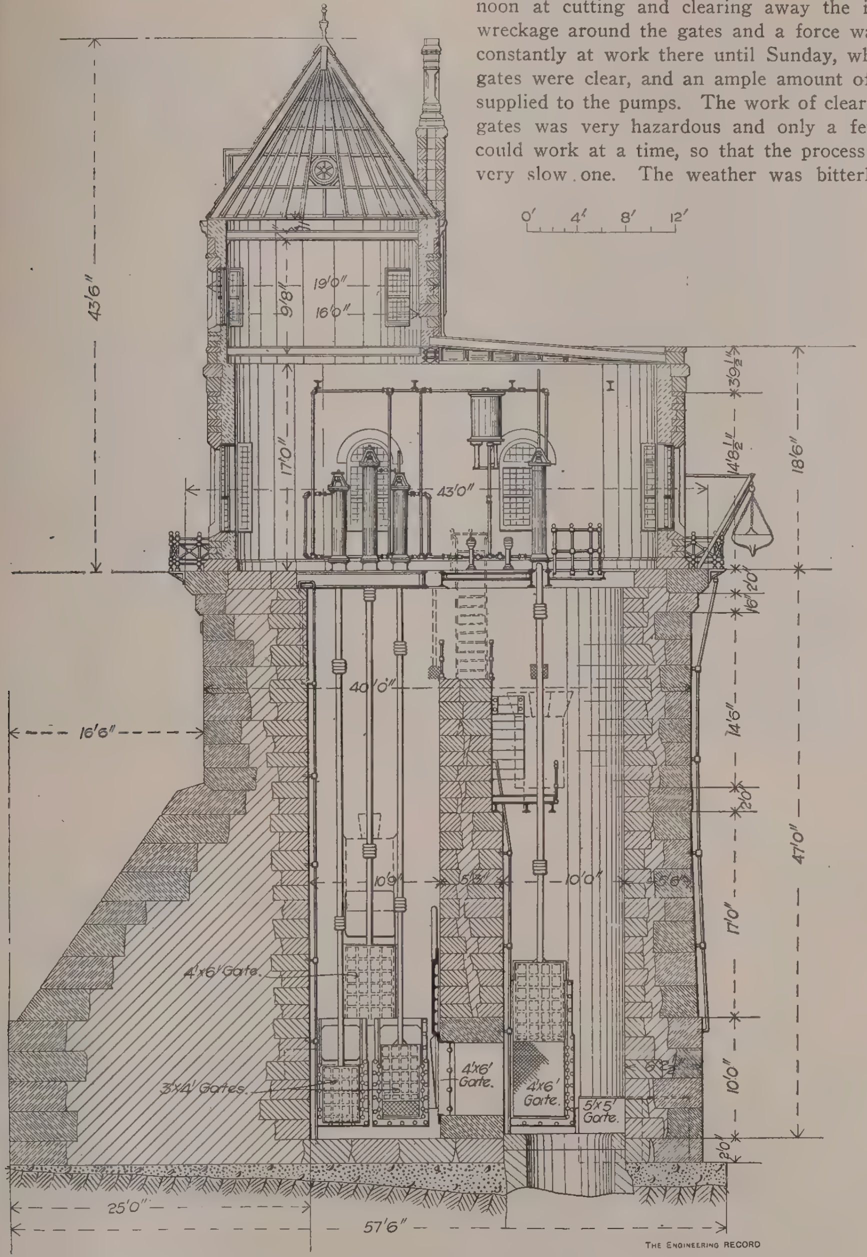
(5) Of the timbers treated by the Barschall or Hasselmann process, the beech, hemlock and tamarack have fungi growing on the ends. These timbers were treated in the second run, which, as stated by the report of the representative of the Barschall Company, did not give proper treatment. The oaks and pine treated by the Barschall process are so far sound.

(6) The results of the test clearly indicate that where timbers treated by various processes are to be compared they should be treated preferably in large quantities, and as nearly as possible under the usual conditions governing the treatment of timber for commercial purposes.

Ice at the Intake of the St. Louis Water Works.

By Edw. E. Wall, Principal Assistant Engineer, Water-works Extension.

The intake tower of the St. Louis Water-works has a boom constructed of heavy timbers lashed to the upstream end of the tower and extending diagonally downstream and towards the main channel, serving as a guard to fend off the floating ice. This boom is 60 ft. long, 12 ft. wide by 9 ft. deep, floating at about half its depth. Directly inside the downstream end of this boom is a shallow flatboat 7 ft. by 30 ft., provided with adjustable curtains on the side next the tower. These curtains extend from the water surface to a maximum depth of 10½ ft. The positions of boom and flat boat are shown in the drawings. With this arrangement little or no trouble was experienced from the ice this winter until the afternoon of Friday, Feb. 3, when the ice which was gorged above the tower began moving toward the Missouri shore where lay a large open space of water free from ice. The movement of the ice above the tower crowded the ice against the boom and flat boat, pushing the flat boat against the tower and shutting off the water from the tower gates. The boom withstood the strain and was comparatively uninjured. The flat boat was crushed and broken, and in its movement, struck and broke the 6-ft. cast-iron wrench which operates the emergency gate. This gate was closed at the time and the breaking of the wrench rendered the gate perfectly useless as it was some 5 ft. below the surface.



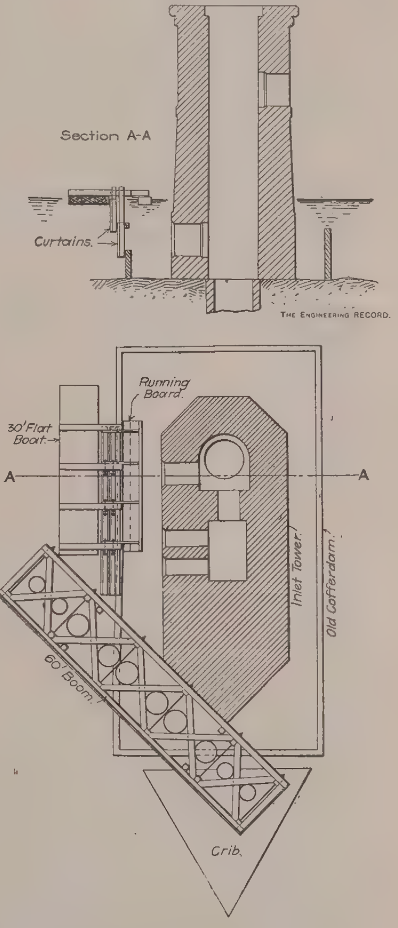
Inlet Tower, Low-Service Extension, St. Louis Water-works.

After the ice had quit moving some water found its way through the gates, but not enough to keep the pumps going. All of Friday night and a portion of Saturday the supply was less than one-half the usual amount pumped by the low service pumps. Men were set to work on Friday afternoon at cutting and clearing away the ice and wreckage around the gates and a force was kept constantly at work there until Sunday, when the gates were clear, and an ample amount of water supplied to the pumps. The work of clearing the gates was very hazardous and only a few men could work at a time, so that the process was a very slow one. The weather was bitterly cold and the men were changed every two hours.

It has been necessary to keep men cutting the ice off the gratings over the gates during all of this cold weather. No further trouble is anticipated until the ice in the river breaks up, and it is impossible to forecast the change in conditions which that will make. The worst that can happen is to have the boom and the remains of the flat boat swept away by the ice, leaving the tower gates unprotected. We have a small flat boat swung on davits which can be drawn up out of the way of the ice and which will be lowered to make a platform for men to work from, after the ice goes out. We have also replaced the broken wrench on the emergency gate by a new casting, so that the emergency gate can be put in service, provided the river does not rise so high as to entirely submerge the casting. In this case there will probably be little or no trouble in drawing all the water we need through the other gates. The stem operating the emergency gate will be extended up to the tower balcony, as soon as the material necessary can be made and put in place, so that in the future it can be operated at all times regardless of the stage of the river.

Last year and on several previous years, a great deal of trouble was experienced with anchor or needle ice coming through the tunnel into the wet well and thence into the pumps, clogging them and preventing the flow of water. In 1900 an elevator was built in the south end of the wet well to take out the ice and dump it into a manhole from which it was washed back to the river through a 24-in. pipe. Last year this elevator broke down almost at the first attempt to operate it to remove the ice. The endless chain carrying the buckets was broken by being locked by a log which floated in through the tunnel. It was impossible to repair it at the time, on account of the rapid accumulation of the ice in the wet well, and the imperative necessity of removing it without at the same time shutting off the supply of the water.

Two hoisting engines and derricks were immediately set up and men put in the wet well to shovel the ice into boxes. The ice at this time was fully 20 ft. thick in the well. For eleven days and nights the engines hoisted ice as fast as they could be operated, each one removing approximately 500 cu. yd. of slush ice per 24 hours. Then came a spell of warmer weather for about two weeks, when the work of removing the ice had to be resumed. This time it lasted for ten days and nights. This work required the



Boom and Curtain at Tower

services of 150 men divided into eight-hour shifts.

In order to prevent a repetition of this expensive experience, the old elevator was repaired last summer and another one built at the north end of the wet well. There has been no necessity up to the time of writing (Feb. 15) for using either of these machines this winter. The river has been blocked, and there has been no anchor or needle ice formed during this severe weather. The river being covered the water has been protected from the cold. With the breaking up of the ice, should any severe weather ensue, the needle ice will be formed. Whenever the river falls below 20° F. the needle ice begins to form.

The Design of Reinforced Concrete Floors.

By H. Alexis d'O. Saubrey, of the Engineering Staff of the Ransome & Smith Co.

It is well known that most of the formulas used in connection with reinforced concrete construction are very complicated. Considering, however, our present limited knowledge of the actual stresses in a reinforced concrete beam subject to a bending moment, it seems justified to use only such simple formulas as are well established by years of success and are on the safe side. Such a formula is used extensively in the United States by the Ransome system, and abroad by Wayss & Freytag, a large concern doing business in Germany, Austria and Luxemburg, and others.

Let the beam in question be subject to a bending moment M expressed in ton-inches, and denote by d the depth in inches of the beam from the top to the center of the reinforcing rods, Fig. 1, and by S the total stress in the steel rods in tons.

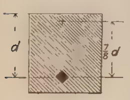


Fig. 1

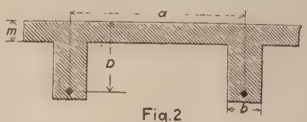


Fig. 2

Then $S = 8M \div 7d$. This formula is derived by assuming the distance from the center of compression in the concrete to the center of tension in the steel equal to seven-eighths of the depth, d. Although approximate, it gives a very close and reliable value for the stresses in the steel. As to the amount of concrete, an easy investigation will show that if 16 sq. in. of concrete are placed above the steel, then the compression in the concrete will never exceed 500 lb. per square inch.

Considering now a 1-in. wide strip of a slab, or flat floor construction, and denoting by t the uniformly distributed load in pounds per square foot, l the length, or span, of the slab in feet, and d the depth to the rods in inches, then we have after the formula above $S = 12tl^2 \div 14{,}000d$.

As stated above, there must be 16 sq. in. of concrete above the center of the steel rods, hence $12d = 16S$, or $S = \frac{3}{4}d$. Equating the two values of S and solving for d, it will be found that $d = l\sqrt{t} \div 30$ approximately.

This formula gives the required depth d of the slab in inches, and the corresponding stress S equals $\frac{3}{4}d$ tons.

For many years these formulas have been used in these or similar shapes, and the writer would not have drawn attention to this fact if he did not believe that a great and very practical reduction can be introduced in the designer's work by transforming the formulas. In fact, the load t or the moment M used in the calculations must include not only the superimposed load, but also the dead load. When starting the work, the designer must assume this dead load, and a serious error may be introduced thereby, especially when the conditions are exceptional as to load or span. It is therefore the air of the following lines to transform the formulas in such a way as to eliminate the assuming of the dead load.

Slabs.—The total load is composed of: 1, The superimposed load, say p lb. per square foot. 2, The concrete above the steel rods, or a thickness of d in., weighing $12d$ lb. to the square foot. 3, The concrete below the rods, assumed to a probable average of 10 lb. per square foot. Consequently, t equals $p + 12d + 10$ lb. per square foot, and

$$d = \frac{l}{30}\sqrt{(p+12d+10)} \qquad d = \sqrt{(p+12d+10)} \div 30$$

$$d^2 - (12l^2 \div 900)d - (p + 10)\ (l^2 \div 900) = 0$$

$$d = \frac{l^2}{150} + \sqrt{\left(\frac{l^4}{150^2} + \frac{(p+10)\,l^2}{900}\right)}$$

Cancelling the very small value $l^4 \div 150^2$, and writing $l^2 \div 125$ in place of $l^2 \div 150$, we have

$$d = (l^2 \div 125) + (l \div 30)\sqrt{(p + 10)}.$$

It will be remembered that p represents the live or superimposed load on the floor in pounds per square foot, and l the span in feet, and we have then a formula that allows an easy determination of d without assuming the value of the dead load.

The exactness of the formula is far greater than naturally would be expected of an approximation. Practically, spans under than, say, 10 ft. are very scarce for a flat slab construction. Assume, for instance, a span of 12 ft. and a load of 150 lb. per square foot, then $d = 6.2$ in. Trying this on the old formula, we have $t = 150 + 6.2 \times 12 + 10 = 234.4$; $d = {}^{12}/_{30}\sqrt{235} = 6.14$ in.

Ribbed Floor Construction.—We will now consider a ribbed floor construction, Fig. 2, and denote by a the spacing of ribs in feet, m the thickness of slab in inches, b the breadth of rib in inches, D the depth to steel in inches, and S the stress in steel in tons. We derived above the formula $d = l\sqrt{t} \div 30$, but, if we for a certain depth d substitute another depth D, we will get another stress s, equal to $Sd \div D$, because $s/S = d/D$, $s = Sd/D = 3d^2/4D$, still remembering that the stress s corresponding to d equals $\frac{3}{4}d$ tons. Then $s = l^2t/1200D$.

Referring to Fig. 2, it will be evident that the value of t is composed of: 1, A superimposed load of, say, p lb. per square foot; 2, weight of the slab $12m$ lb. per square foot, and 3, weight or the rib, approximately $bD \div a$ lb. per square foot, or $t = p + 12m + bD/a$. Hence $s = (l^2 \div 1200D)\ (p + 12m + bD/a)a$, the factor a being introduced because the stress now is concentrated in rods a foot apart. This gives

$$\frac{(12m + p)\ l^2}{1200D} \times a + \frac{bl^2}{1200} = s$$

A very common example has ribs 4 ft. on centers, thickness of rib 4 in., thickness of slab 3 in., in which case the formula reads $s = (36 + p)\ (l^2 \div 300D) + (l^2 \div 300)$. Any example will prove that the exactness of this formula is far beyond what the very best practice requires.

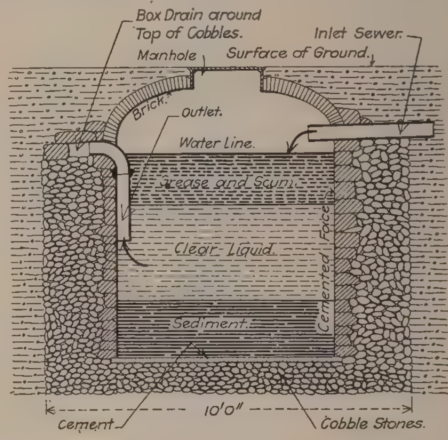
When the beams are calculated the stresses in the girders may be found by exactly the same formula, only adding to $12m + p$ the weight of the beams, distributed per square foot of floor, and denoting in above formula by l the span of the girder in feet, D the depth of the girder in inches, b the width of the girder in inches, and a the spacing of the girders in feet. The outside girders in a floor construction have to carry only half the load the inside girders carry, and in this case only half the value of a is to be used in the formula.

The writer believes the above formulas to be of great usefulness. In fact, much time can be saved by using them, and in most cases a higher degree of exactness is obtained than when the weight of the construction must be assumed in advance. The derivation is here shown for one certain system of formulas, but a similar proceeding may be applied on other systems. It is, however, doubtful whether successful results can be obtained when the fundamental formulas are too complicated, as is frequently the case.

A Septic Cesspool.

The cesspool does not furnish, as commonly constructed, an ideal method of sewage disposal, but is bound to be largely used to dispose of wastes from private houses in the country and small villages. From the landlord's point of view, its greatest objection is its liability to clog and become water-tight. This may take place in a very short time in tight soils, or in fine sand. The bottom soon becomes choked with sediment and grease, and the water line rises, thus bringing fresh surfaces around the sides in use. These gradually clog with floating soap and grease, forcing the water line higher and higher, until the pool is full and almost water-tight, when the only remedy is the building of a new one.

The sketch shows a septic tank and leaching pool in one construction. The aim of the design is to arrest the sediment and scum, and bring only comparatively clear liquid in contact with the absorbing surfaces, thereby prolonging the life and usefulness of the cesspool indefinitely. By proportioning the tight inner chamber, so as to have a capacity for about 36 hours' output, septic action may take place without putrification and the attending odor and gases. The construction, as shown in the sketch, does not entail any large additional first cost, and will, no doubt, in most cases furnish permanent disposal. The design has been made by Mr. Fred. K. Betts, assistant engineer of the Department of Water Supply of New York City, who has charge of the Sanitary Patrol of the Croton Watershed.

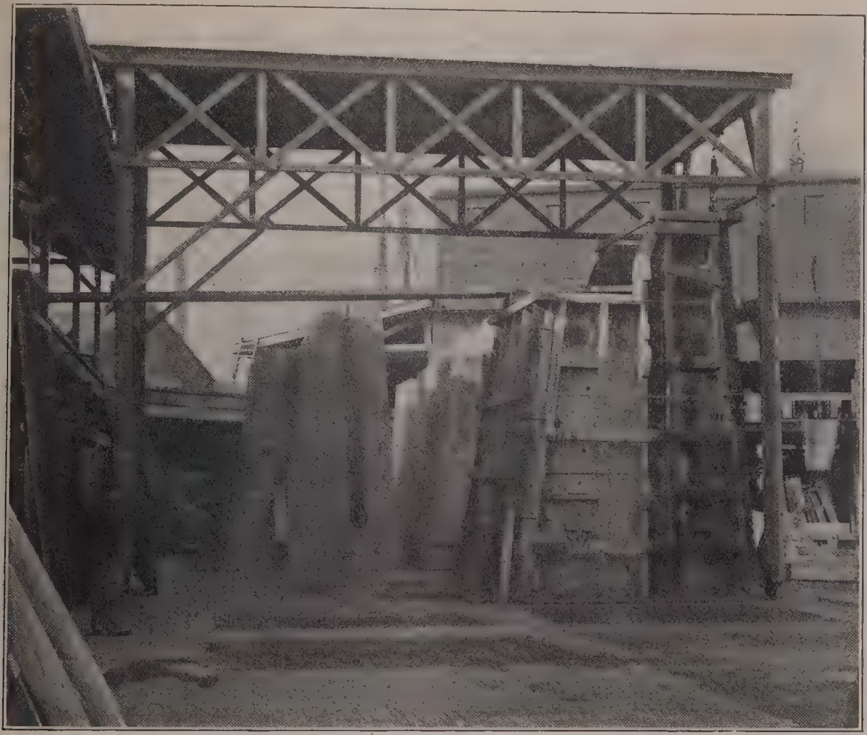


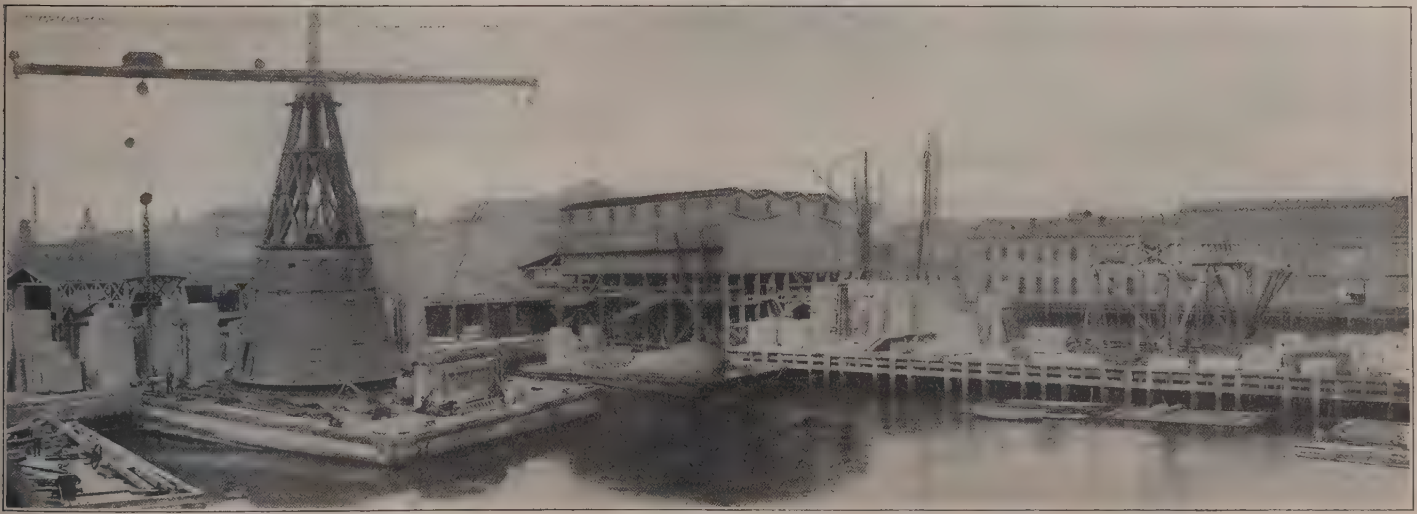
A Septic Cesspool.

A Two-Generator Steam Engine Unit of interesting proportions is in use in the power station of the Harland & Wolff shipbuilding yard at Belfast, Ireland. Two of the three 1,000-h.p. engines installed drive in each case a three-phase generator and a direct-current machine. The two machines have a capacity of 650 kw. each, so that the engine can drive one of its two generators at full load and the other partly loaded, or both at about three-quarters full load. One reason for this arrangement, according to the London "Electrician," is that at night time one main engine is sufficient for all purposes. The generators are Lahmeyer machines and the engines are Sulzer four-cylinder horizontal triple-expansions with 17.32-in., 27.55-in. and 31.49-in. cylinders, there being two of the latter, and 47.25-in. stroke.

The Manufacture of Concrete Blocks for the New York Sea Wall.

It is the policy of the Department of Docks of New York City to build permanent massive concrete and granite sea walls along the water front as fast as the property is acquired for the city. Yards have been established by the Department at East 24th St. and at West 57th St., where very large concrete blocks of both standard and special design are built and shipped to different localities where they are needed. The general type of wall has been illustrated several times in The Engineering Record, and consists essentially of one or two courses of moulded concrete blocks, with granite facing above an elevation just below low water, and a backing of rip-rap with earth fill on top. The face of the wall is curved and the rear has rectangular offsets. The upper part of the wall is stepped down in front to give a seat for the granite and for its monolithic concrete backing, which is deposited in moulds above low water. The dimensions of the blocks vary with the location to a maximum of about 15½ ft. width at the base, 18 ft. height and 10 ft. length, with a maximum weight of about 86 tons. Where the depth of the water will permit, the wall is built with a single submerged course, and where two courses are necessary the lower one is not less than 5 ft. high.


Mould for 84-Ton Block, Wheeling Bridge and Canopy.


General View of Concrete Block Plant, Department of Docks and Ferries, East 24th and 25th Streets, New York.

Where the wall is built on a pile foundation, the piles, about 3 ft. apart on centers, are cut off under water and a mattress is placed between the pile tops and the bottom of the wall. The mattress is made of jute bagging filled with 1½:2 Portland cement mortar and sewed to a wooden frame slightly larger than the horizontal dimensions of the base of the block. This is lowered and adjusted in place on the pile tops by a diver, the frame cut away from the mattress and the former removed. The block is placed on the mattress before the cement in it has set, and compresses it to a thickness of about 2 in. forming a uniform bearing for the base of the block.

Where the wall is built on a rock bottom, preliminary surveys, soundings and profiles are made and studies from them determine whether the wall is to be made in one or two courses. In any case the bottom is levelled with concrete bags placed by a diver to a height of not more than 5 ft. at the heel of the wall.

At West 24th St., where the blocks are moulded, sand and broken stone are received from barges and unloaded by 15 cu. ft. steel buckets handled by a boom derrick which hoists and empties them in three-wheeled Stuebner barrows on the upper deck of the West 25th St. pier. This pier is 60 ft. wide and 700 ft. long, and at the shore end a length of 70 ft. is three stories high. The second floor, about 14 ft. above the main deck, is 6 ft. below the bottom of the forty covered stone and sand bins, each of 35 cu. yd. capacity, which occupy the whole of the upper story, on the deck of which the cars are pushed to position over any of the bins and dumped. The bins are provided with swinging side chutes to deliver materials to boats for use on monolithic work, and have flat bottoms with horizontal steel sliding gates commanding openings through which their contents are discharged into cars on the second floor of the pier and transported thence to the mixing platforms. These are located on a continuation of this floor across the river front between the piers at the foot of 24th and 25th Sts. Here there is a pile dock 30 ft. wide and 200 ft. long with a heavy plank deck where two rows of thirteen large blocks each can be stored.

One barrel of Atlas, Trowel or Hudson brand of Portland cement, 2 bbl. of sand and 5 bbl. of 2-in. broken stone are emptied on the mixing platform and turned over by six men with shovels, loaded in wheelbarrows and delivered to the moulds. The mixing platforms are always located directly opposite the moulds, and the concrete is wheeled to the latter over narrow bridges 10 to 20 ft. long. Two men in the mould tamp the concrete and the total number of men required for each mixing gang is sixteen. These average thirty-three ⅝-yd. batches in 8 hours, and it requires 63 batches to fill the mould for an 84-ton block.

The moulds are made with 2x5-in. tongue and groove planed spruce for the sides and 3x12 and 3x8-in. spruce for the battens. The latter are trussed by ¾-in. and ⅞-in. steel horizontal rods about 4 ft. apart vertically, which are fillered out at the center a few inches from the faces of the battens. The moulds usually last about a year, and then cracks begin to open between the boards, which do not really injure the blocks, but impair the finish of the surface. It takes a gang of six ship carpenters about a day to set up a mould and sludge it inside with hot tallow, and about as long to strip it from the concrete block, not counting occasional aid from other men.

Two horizontal wooden cores with elliptical cross-sections about 14 in. in diameter are placed parallel to the axis of the sea wall near the front and rear faces of each block a little above the bottom to make holes to receive the two lifting chains with 2-in. diameter iron stud links. From the ends of these cores semicircular cores 7 in. in diameter, slightly inclined from the vertical, are set in the ends of the block to form grooves for the chains to lead to the hoisting tackle. When the blocks are set in place in the wall with their ends in contact, a pair of adjacent end grooves form a well which, with the horizontal cored hole, is filled with bags of concrete, keying the blocks firmly together. A light movable tower, with a canopy to shield the workmen from the sun and weather, is set over any mould on which the men may be working. After the block is seven days old the mould is stripped off, and when the block is needed in the wall it is lifted from the dock by a floating derrick with a capacity of 100 tons at a radius of 23 ft. The derrick loads three blocks on a 70x30x7½-ft. scow, and both scow and derrick are towed to the site of the sea wall, where the derrick lowers the blocks to the foundation prepared by divers who also adjust the blocks in position.

The outer end of the 25th St. pier is used for the storage of granite blocks from Deer Island and Hurricane Island, Me., from Goshen, N. Y., and from Connecticut and other quarries. The blocks are handled at the yard by two 5-ton electric trolley hoists on a wooden travelling gantry crane of 40-ft. gauge and 35-ft. vertical clearance. At the sea wall they are placed by a 12-ton floating crane. The granite is tested in 2-in. cubes, which are required to develop a crushing strength of 17,000 lb. per sq. in. The amount of concrete work done at this yard varies with the requirements for new wall, and usually keeps pace with them. At present it amounts to about 40 cu. yd. per day, two gangs being employed in filling the moulds for large blocks. A somewhat greater yardage is made when the concrete is built in monolithic moulds at the site.

The work is under the direction of Mr. J. A. Bensel, engineer-in-chief of the Department.

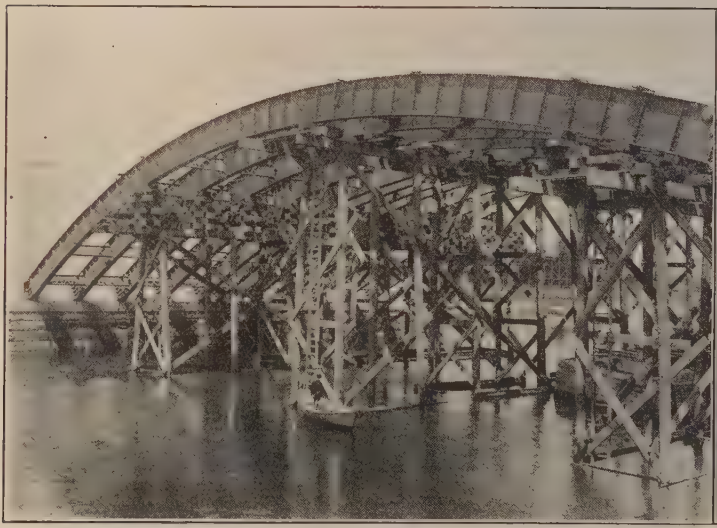
Erection of the Cambridge Bridge, Boston.

The Cambridge bridge, across the Charles River between Boston and Cambridge, is an important highway structure designed to carry very heavy street and elevated railroad traffic, and to present an artistic appearance in harmony with the surroundings and the eventual improvement of the river and shores. It is 105 ft. wide in the clear and 1,767½ ft. long, and has eleven two-hinge arch spans, from 145 to 188½ ft. long in the clear. Each span has twelve steel plate girder ribs of 8.43 to 26.67 ft. rise, and from 3 ft. 9 in. to 4 ft. 6 in. deep, from back to back of angles. Vertical spandrel posts are seated on the top flanges of the girders, and carry the floor beams and stringers, which are covered with a solid steel-plate floor and paving. The skewback pins are 16 ft. above mean low water, and the depth of water varies from 4 to 16 ft. at low tide. The bottom consists of soft mud, sand and clay, overlying a hard stratum of gravel from 30 to 60 ft. below low tide. The mud is so soft that foundation piles would sink several feet without driving under the 22,000-lb. load of steam hammer and follower, but after a pile had been driven a short time it set so firmly that it could scarcely be withdrawn. In some instances, piles driven only 8 ft. could not, after a few hours be pulled by a 12-part tackle operated by a 10x12-in. engine.

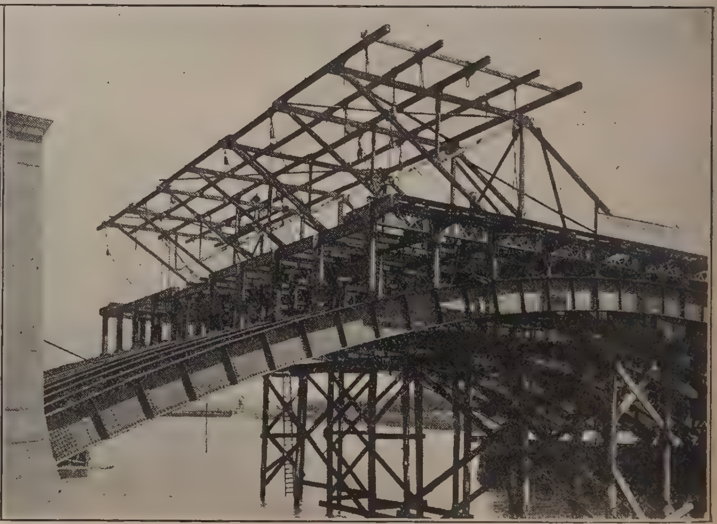
The arch ribs were all delivered at the site by lighters and erected by their derricks on pile falsework, arranged in the form of center and intermediate towers. The six short end spans and the two adjacent 145-ft. spans were supported only at the skewbacks, on the piers, and at the crown on single towers; the longer center spans were supported on the piers and by three intermediate towers, one at the center and one near each haunch. The towers were all substantially alike, and consisted of two transverse rows of long piles 8-ft. apart. Each row was capped by a 12x12-in. timber, drift-bolted to the piles and made in lengths of 20 to 34 ft., butt-jointed on the pile centers and spliced by side plates. Longitudinal and transverse horizontal pieces were bolted to them just above water level and all panels above that height were X-braced with 3x12-in. planks. Short timber cribwork was built on the trestle caps under each rib and supported the plate girders on pairs of 10x12-in. transverse timbers, and the usual double oak camber wedges.

Side Span Ribs on Center Tower.

Erecting Side Span Semi-Arches



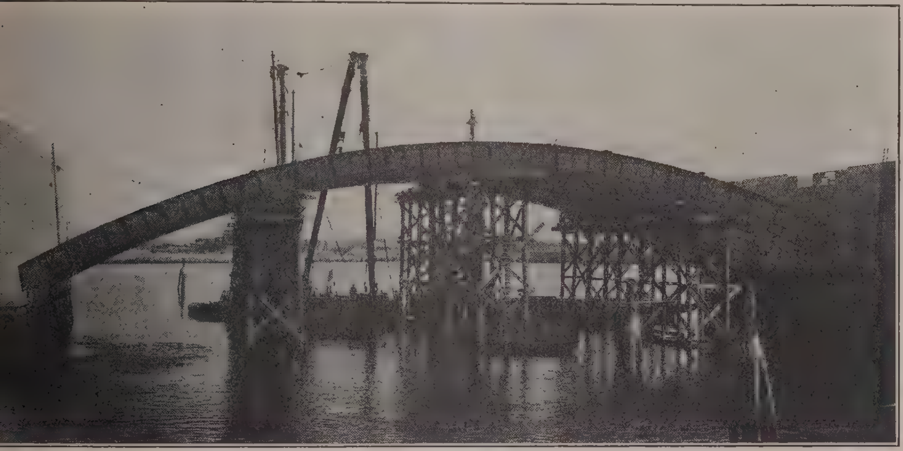
Falsework Towers for Center Span.



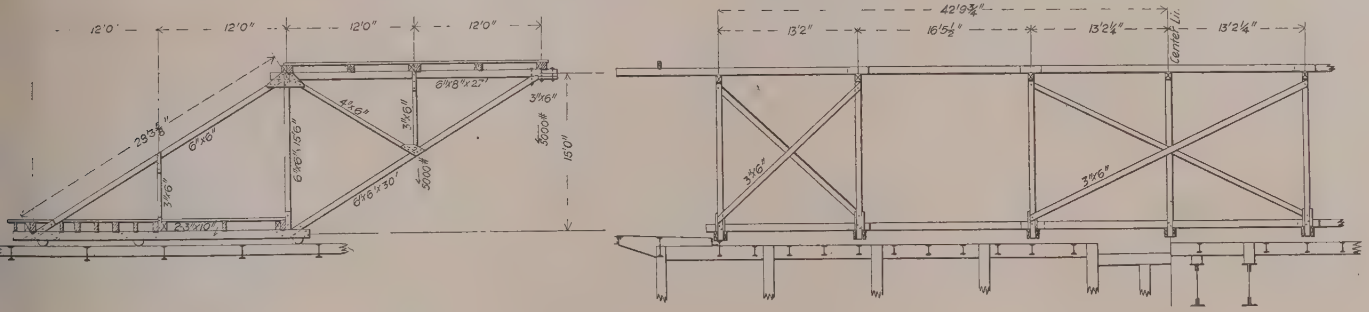
Erecting Floor Platform.

he rib girders for the eight shortest spans re shipped in two sections each, spliced by d-riveted web cover-plates at the crown. Each tion was supported at the lower end by the wback pin through the shoe which was anchorted to the pier masonry, and at the upper end s seated on the falsework tower. A short gitudinal angle was bolted to the top flange of h section at the haunch and received a transse horizontal pin for the connection of the vis end of a guy or back stay inclined about 40 rees to the horizontal in the plane of the gir- web. This guy was made of ⅝-in. plough l rope, had a sleeve nut adjustment, and was d to help make the crown splice adjustment.

he three longest arches in the center of the dge have spans of 159½ and 188½ ft., and each was shipped in four sections with splices at crown and haunches. The end sections of se ribs were supported during erection, as al- dy described, the guy ropes being attached near r upper ends. The crown sections of the ribs e supported on the same towers as the end sec- s and on a single tower in the center of the , and were not provided with any guys. The ework piles were 15 in. in diameter at the , averaged about 55 ft. long, and were driven penetration of ¾ in. under the last blow of 000-lb. hammer falling 15 ft. The heaviest er section weighed about 32,000 lb., and the imum pile load was about 25,000 lb. Very lit- settlement occurred during erection, and the es were swung in the usual way by slacking the camber wedges. Afterwards the web e rivets were driven by Chicago Pneumatic Co.'s hammers, operated by air at 100 lb. pres- , which was distributed in a 2½-in. pipe from pressors made by the Hall Steam Pump Co., Chicago Pneumatic Tool Co. and the Herron ury Manufacturing Co., and located near the er of the river on the protection piles for the porary bridge draw pier.



Erecting Four-Section Ribs of Center Spans



Traveler for Erecting Floor Platform and Spandrel Columns.

fter the arch ribs of the first span were ted an overhead traveler was built at one end e bridge, and moved forward on the floors of the successive spans erecting all the remainder of the superstructure. The traveler had a 76x28-ft. horizontal framework supported on 18 double flange wheels in the vertical planes of the seven longitudinal trusses, which had cantilever projections commanding two panels of spandrel bracing. The trusses were built entirely of timber except that two of the principal connections were made with ¼-in. steel cover plates. Floor platforms were built on the bottom framework at the rear, each side, for two Lidgerwood two-drum, four-spool hoisting engines, which operated the twelve four-part manilla tackles suspended from transverse beams on the top chords of the cantilever trusses. The superstructure weighs about 8,000 tons, and was erected and riveted by an average force of 85 men in about 155 working days. The bridge was designed by a commission, of which Mr. William Jackson, city engineer of Boston, was chief engineer, and Mr. John E. Cheney was first assistant engineer. The contract for the superstructure was awarded to The Phœnix Bridge Co., Mr. John Sterling Deans, chief engineer, and Mr. A. B. Milliken, superintendent of erection.

Books Notes.

Some time ago Prof. J. H. Kinealy began the publication of a series of articles on centrifugal fans in the "Engineering Review." These formed the first complete discussion of such machines published in this country independently of backing from fan builders. The style was thoroughly practical, mathematics being employed only for useful purposes and not for pedantic decorative effects. These papers have been revised and enlarged by their author, and now appear in pocketbook form under the title, "Centrifugal Fans" (New York, Spon & Chamberlain; leather, 16mo, 220 pp., $5).

The first of the six volumes containing the proceedings of the International Engineering Congress held at St. Louis last year has appeared. It has over 500 pages, and is uniform in style with the "Transactions" of the American Society of Civil Engineers, of which it is, in fact, a part. It contains seventeen papers, on the purification of boiler waters, fortifications, railroad bridge loads, mining engineering, harbors, and engineering education. Several of these papers were read by title at the convention, and two, on the construction of concrete blocks for harbor purposes in Japan, contain some very interesting information. The secretary of the Congress, Mr. Chas. Warren Hunt, 220 West 57th St., New York, states that 97 papers were received at the Congress and 124 written discussions, in addition to the oral discussions.

A second edition of "Geographic Tables and Formulas" has been issued by the U. S. Geological Survey. This valuable 311-page manual compiled by Mr. S. S. Gannett and revised by Messrs. E. M. Douglas and H. L. Baldwin, Jr., brings together all the tables and formulas used by the togographer in the field and office. The material is partly original with the members of the Survey, and is partly taken from publications of the U. S. Coast and Geoditic Survey, the Smithsonian Institution and the U. S. Land Survey Manual. The tables and rules for finding the true meridian and for use on sadia surveys will be valuable to many engineers, while the growing interest in careful triangulation in connection with the surveys of large cities renders the manual, as a whole, of special importance at this time.

Mr. Edward Hardy has prepared in his "Elementary Principles of Graphic Statics" a small book which will probably prove useful to a good many draftsmen. It makes no pretense to any higher branches of graphical analysis than those likely to be of assistance in most drawing rooms, but within its field it seems to be very explicit and suitable for self-instruction. (New York, D. Van Nostrand Co., cloth, 16mo, 165 pp., $1.50.)

There seems to be a marked international predilection just now among authors of books on electricity towards works discussing methods of testing electrical apparatus. The latest of these is Mr. Charles Kinzbrunner's "Testing of Continuous Current Machines." It is intended "for students at technical schools and colleges," who ought to devote their time in such institutions to subjects more in keeping with mental development. Although the value of such instruction in an American school is open to argument, the book itself should not be rated any lower on that account. It is actually a clear and minutely particular account of the methods of testing employed regularly in European shops and laboratories. (New York, John Wiley & Sons, cloth, 8vo, 336 pp., $2.00.)

The sixth volume of the final report of the New Jersey State Geologist is an excellent account of the clays and clay industry of the State, by Messrs. Heinrich Ries and Henry B. Kümmel, assisted by Mr. George N. Knapp. It is one of the most thoroughly satisfactory reports of this class that has appeared in a long time, combining scientific accuracy with a great amount of practically useful data to the maker and user of clay products. It will doubtless rank as one of the most important treatises on the industry which is developing so fast in New Jersey.

An unusually comprehensive chart of the capacity of brick and pipe sewers and water mains has been published at 2 shillings in convenient and durable form by Mr. C. W. L. Alexander, 430 Moseley Road, Birmingham, England. The lines for sewers are plotted according to Crimp and Bruges' formula, $v = 124 R^{0.67}S^{0.54}$, while the water main formula is that of Saph and Schoder, $v = 174 R^{0.67}S^{0.54}$. The chart is on the logarithmic system and is well printed. The vertical scale gives the discharge in cubic feet per minute, the horizontal scale the grade, and the diagonals the diameters in inches and the velocities in feet per second.

The famous lecture by Mr. Nikola Tesla before the Institution of Electrical Engineers on "Experiments with Alternate Currents of High Potential and High Frequency," which attracted such great interest in London at the time it was delivered, has been reprinted as a small 172-page book by the McGraw Publishing Co., New York. It is accompanied by a biographical sketch of the author and a review of his recent work in the electric transmission of energy without wires.

Major C. D. Hine, the West Point graduate who resigned from the army because he was a born railway man and simply had to be mixed up with trains in some way, has written an interesting book for aspirants for success in railway work. It is entitled "Letters from an Old Railway Official" to his son, and discusses in familiar and pithy style a great many subjects which will be worth while considering in a wider field than that of railways. It is really a book of suggestions concerning executive work, and the style is best shown by the following extract: "Don't act as call boy or for one second forget that you are the superintendent, that the whole push looks to you." (Chicago, The Railway Age; cloth, 12mo, $1.50.)

MODERN PRACTICAL ELECTRICITY. By R. Mullineux Walmsley. Chicago, W. T. Keener & Co.; cloth, 8vo, 4 vols., $12.00.

The inability of a man whose training has been purely scientific, and whose line of effort has been academic, to write a practical treatise for the use of engineers, is again demonstrated in the four imposing volumes, entitled "Modern Practical Electricity," by R. Mullineux Walmsley, which have recently appeared. Dr. Walmsley is principal of Northampton Institute in London, and a gentleman of high scholastic attainments. That a strictly scientific work by him would possess interest and merit is unquestioned, but this treatise has no place in the engineer's office. In the first place there is much that is archaic as well as modern about it. All the ancient and honored ideas, methods and cuts so dear to us from childhood's memories as associated with Ganot's "Physics," Stewart & Gee, and the rest of our long since departed friends, are here again presented before us. The text, to be sure, is better than the things of yore and shows the hand of an erudite compiler, but this portion is not modern. That all this is interesting and every engineer should be familiar with it is obvious, but a "practical" work gives information that is precise, definite, quickly located and applied to every-day practice.

There is, of course, a great deal in these books that is modern and represents present-day practice, but this part of the information is hedged about by academic, historical and obsolete matter that seriously detracts from the value of the work viewed from a practical standpoint. In the whole range of 1,200 pages it is difficult to find anything other than a clear, academic treatment of things electrical, forming a compendium for the layman of scientific tastes, its cyclopaedic character well fitting it to fill such a place. It is an excellent work of its kind, i. e., containing the electricity of Ganot, the equivalent of the contents of Ayrton's "Electricity," Stewart & Gee's books, and part of Thompson's "Dynamo Electric Machinery," but its prospects and possibilities are injured by the title given it, a defective and short-sighted christening and a misleading baptism.

WEBSTER'S INTERNATIONAL DICTIONARY OF THE ENGLISH LANGUAGE. Springfield, Mass., G. & C. Merriam Co.; sheep, 12x16 in., 2,380 pp., $10.00.

The new edition of Webster's famous dictionary is, like its predecessors, eminently useful. The publishers have studied the dictionary requirements of busy men for two generations, and have been improving the book by condensing as well as enlarging the previous editions. They have not attempted to manufacture a new language, to supply data of interest only to philologists, or to pad the book with useless illustrations. They have endeavored to ascertain what information is really useful in the business office and the working library of a professional man, and to supply only that information. Every revision has been made with the idea of improving the clearness and accuracy of definition, particularly of technical terms. New editions are brought out as soon as the development of the language makes them desirable, and the latest one is an excellent example of intelligent and accurate editorial work along the lines indicated. There is a general tendency to swell dictionaries out of all reasonable limits for practically useful books, and the absolute disregard by the Merriam Co. of this padding proclivity is most welcome. Webster's dictionary has been used in this office for many years, and there has never been any valid reason for selecting any other.

Letters to the Editor.

THE DESIGN OF CONCRETE CULVERTS.

SIR:—In your issue of March 4, 1905, under the caption, "The Cumberland Extension of the Western Maryland R. R.," you publish the design of twin 20-ft. concrete arches, which contains one feature that does not appeal to me as being reasonable. I do not understand why the side walls of the waterways, from the springing down, should be battered rather than vertical. The span of each arch at the springing is 20 ft., but at the bed of the stream, where the greatest span is desirable, the waterway is narrowed to 18 ft. 4 in. The result is a decreased waterway area, a decreased span at the most vital point, and added material, with no increase in strength, hence a considerable waste.

This feature has been introduced in a number of concrete arch designs, more especially on railway arches, and I am curious to know whether or not the designers of such structures have any good reason for battering the side walls.

Very truly yours, DANIEL B. LUTEN.
Indianapolis, Mar. 17.

SIR:—Replying to the question of your correspondent, will say with regard to battered side walls as follows:

In the case of culverts having comparatively high side walls, it seems to be a doubtful question whether the thrust or overturning tendency will be in a direction inward or outward. On account of the thrust from the arch ring, I believe it is usually considered that any overturning tendency, as to the side walls, would be in an outward direction; on the other hand, some authorities have considered that it might be in the opposite direction. At any rate, a side wall with batter on both sides has a tendency to provide for this indefiniteness, as it is not a case where any amount of figuring can exactly determine the conditions.

Another minor reason for battering the side walls is to gain a spread for the foundations.

The two above considerations are, however, of no very great importance. The principal reason for battering the side walls is to avoid the angles and shoulders which would otherwise have to be built at the ends of the barrel, provided we secure a batter on the wing walls, which latter is considered important on the larger sizes of culverts.

With culverts under 10 ft. span we make vertical side walls and vertical wing walls; with larger culverts, we deem it essential to secure a batter on the wing walls, and, therefore, we put a batter on the culvert side walls, so that these two battered faces may simply meet in a right line which shall lie in the vertical plane of the end or parape wall.

Any one familiar with this kind of constructio will note the advantages of this form for th passage of water, to say nothing of the decrease expense and simplification of the moulds, provided the work is built in concrete, as ours is.

The decrease in the width of water-way at th bottom of the culvert, due to this batter, is no considered important. For all but a few days i the year the bottom width of the culvert make but little difference; in fact, half the width woul usually be sufficient without any tendency to bac up the water. During the flood season the wate is sufficiently high to utilize the opening to i fullest extent, and often to a point above th springing line.

Yours truly, J. Q. BARLOW,
Ch. Engr., W. Md. R. R.
Cumberland, March 30.

COMPARING WATER MAIN SYSTEMS.

Sir: Referring to your leading editorial in th issue of April 1, "The Rogers Park Water Rat Case," you state in this, "The city, for instanc has about 1,890 miles of mains, with a consum for each 33½ ft. of pipe, while the company h a little over 22½ miles, with 120 ft. per co sumer." Have you enough data to reduce t 1,890 miles of city mains to a fixed size, say, 8 i diameter, and then state the number of feet 8-in. pipe per consumer; likewise reduce the 22 miles of the company's pipes to the equivalent 8-in. pipe, and state the number of feet per co sumer?

This seems to me to be the proper comparis While the city would probably have fewer feet pipe per consumer, the average diameter of t pipe placed by the city would probably be mu larger than the average diameter of pipe plac by the Water Comany; and it has been my cu tom on matters of this kind to reduce the pi system to some uniform size, as, for example, system containing —— ft. of 24-in., —— ft. of in., —— ft. of 16-in., —— ft. of 12-in., —— ft. 8-in., —— ft. of 6-in., and —— ft. of 4-in., co be reduced to equivalent lengths of, say, 8-in. 12-in. pipe. It seems to me that in no other w could a comparison such as you indicate be pr erly made. I would be glad to have any other formation upon this subject that is readily tainable.

Yours very truly, JOHN W. HILL
Philadelphia, April 4.

COUNTRY ROADS in the flat districts of N South Wales, where no stone is to be had. now made with "an embanked formation fr 30 to 35 ft. wide, and with a convexity of 12 i The material is obtained from ditches 20 ft. each side of the formation.

CURRENT NEWS SUPPLEMENT

APRIL 15, 1905.

RY OF NATIONAL TECHNICAL SOCIETIES.

SOCIETY OF CIVIL ENGINEERS. Sec-s. Warren Hunt, 220 West 57th St., Annual convention, Cleveland, June xt meeting, April 19.

SOCIETY OF MECHANICAL ENGINEERS. F. R. Hutton, 12 West 31st St., New xt meeting, New York, April 25, last reunion of the season, to which invited; paper by Mr. G. C. Hen-amond tools.

INSTITUTE OF ELECTRICAL ENGI-cretary, Ralph W. Pope, 95 Liberty York. Annual convention, Asheville, e 19-23. Next meeting, at Carnegie 28; four papers on meter subjects.

INSTITUTE OF MINING ENGINEERS. R. W. Raymond, 99 John St., New

N INSTITUTE OF ARCHITECTS. Secre-Brown, Washington, D. C.

ION OF ENGINEERING SOCIETIES. Sec-n C. Trautwine, Jr., 257 South Philadelphia, Pa.

N SOCIETY OF HEATING AND VENTI-GINEERS. Secretary, W. M. Mackay, St., New York.

SOCIETY OF CIVIL ENGINEERS. Sec-ment H. McLeod, 877 Dorchester St.,

FOR THE PROMOTION OF ENGINEERING Secretary, Prof. M. S. Ketchum, of Colorado, Boulder, Colo.

N SOCIETY FOR TESTING MATERIALS. Prof. Edgar Marburg, University vania, Philadelphia, Pa.

N SOCIETY OF MUNICIPAL IMPROVE-cretary, George W. Tillson, Room 12, Building, Brooklyn, N. Y.

ION OF RAILWAY SUPERINTENDENTS OF D BUILDINGS. Secretary, S. F. Pat-cord, N. H.

N RAILWAY ENGINEERING AND MAIN-WAY ASSOCIATION. Secretary, L. C. 2 Monadnock Block, Chicago.

N WATER-WORKS ASSOCIATION. Sec-M. Diven, Charleston, S. C. Annual at West Baden, Ind., May 8 to 12.

N FOUNDRYMEN'S ASSOCIATION. Sec-hard Moldenke, P. O. Box 432, New

SPECIFICATIONS FOR STEEL RAILROAD BRIDGES.

ort was submitted to the American ngineering & Maintenance of Way As-at its recent convention, by a com-sisting of J. P. Snow, bridge engineer, Maine R. R., chairman; J. E. Greiner, f bridges and buildings, Baltimore & R.; John Brunner, assistant general lent, North Works, Illinois Steel Co.; own, chief engineer, Boston Bridge of. C. L. Crandall, Cornell University; veth, engineer and superintendent of d buildings, Chicago, Milwaukee & St. W. M. Hughes, consulting engineer; e, engineer of bridges and buildings, d System; C. D. Purdon, engineer of e of way, St. Louis & San Francisco C. Schneider, Pres. Am. Soc. C. E.; cester, consulting engineer.

PART FIRST.—DESIGN.

Part First—Design—was received as report, and referred back for revision t of the discussion.)

I, General Features.

d of Material.—The material in the ures, except rivets, and as otherwise shall be structural steel.

rance.—On a center line, the clear through bridges shall not be less than e top of rails for a width of 6 ft. over ack, and the clear width shall not be ft. from center line of the track be-heights of 4 and 17 ft. above the rails. shall be increased to provide the same clearance on curves, for a car 80 ft. 59 ft. center to center of trucks, allowance being made for curvature and superelevation of rails.

(3) *Spacing Trusses.*—The width center to center of plate girders or trusses shall be in no case less than one-twentieth of the effective span, nor than would be necessary to prevent overturning under the assumed minimum loading.

(4) *Skew Bridges.*—Ends of deck plate girders and track stringers of skew bridges at abutments shall be square to the track.

(5) *Ties.*—Wooden tie floors, where used, shall be proportioned to carry the maximum wheel load, with 100 per cent. impact, distributed over three ties; fiber strain on ties not to exceed 2,000 lb. per sq. in., and the length to be not less than the total distance over the outer edge of supports plus 12 in. They shall be spaced with not more than 6-in. openings, and shall be notched to a tight fit over supporting girders, depth of notch to be not more than 1½ in.

(6) *Guard Timbers.*—Guard timbers shall be not less than 5x8 in. laid with the 8-in. face down, notched over each tie and securely fastened.

II, Loads.

(7) *Dead Loads.*—The dead load shall consist of the estimated weight of the entire suspended structure, assuming timber to weigh 4½ lb. per ft. B. M., and the rails and fastenings 150 lb. per lineal foot of track.

(8) *Moving Load.*—The moving load shall consist of two consolidation engines followed by a train load, according to Cooper's series, or a uniform system of loading practically equivalent to the same. The minimum loading to be according to the following diagrams:

[Note: The minimum loading shown in diagram is the conventional Cooper's E40 with 4,000 lb. per ft. following load, or two 50,000-lb. driver-axle concentrations spaced 7-ft. centers, the diagram that gives the larger binding moment to be used.]

(9) *Heavier Loading.*—Heavier loadings shall be proportional to the above diagrams on the same spacing.

(10) *Impact.*—The dynamic increment of the moving load shall be added to the maximum computed live-load strains, and shall be determined by the formula $I = 300S \div (L + 300)$, where I = impact to be added to the live-load strains; S = calculated maximum live-load strain; L = loaded length of track in feet producing maximum strain in members.

(11) *Lateral Load.*—Truss spans shall have their lateral systems designed for a force of 600 lb. per linear foot of the loaded chord, and 200 lb. per linear foot of the unloaded chord. Girder bridges shall have the lateral system at the loaded chord designed for a force of 600 lb. per linear foot, these forces being considered as moving.

(12) *Wind Load.*—On viaduct towers provision shall be made for a wind force of 50 lb. per sq. ft. on 1½ times the vertical projection of the structure unloaded; or 30 lb. per sq. ft. on the same surface plus 12 ft. for height of train when the structure is fully loaded, or when loaded on either track with empty cars assumed to weigh 900 lb. per linear foot.

(13) *Longitudinal Force.*—Provision shall be made in structures for a longitudinal force, applied at the rail, of 2/10 of the moving load.

(14) *Centrifugal Force.*—Provision shall be made on curves for the centrifugal force produced by the full live load, running at a speed to be determined by the engineer for each case, acting at a height of 5 ft. above the rails.

III, Unit Strains and Proportion of Parts.

(15) *Unit Strains.*—All parts of structures shall be so proportioned that the sum of the maximum strains shall not exceed the following amounts in pounds per square inch, except as modified in paragraphs 21 to 24:

(16) *Tension.*—Axial tension on net section, 16,000.

(17) *Compression.*—Axial compression on gross section, $16{,}000 - (70l \div r)$, where l is the length of member in inches and r is the least radius of gyration in inches.

(18) *Bending.*—Bending, on extreme fibers of rolled shapes, built sections and girders; net section, 16,000. On extreme fibers of pins, 24,000.

(19) *Shearing.*—Shearing, shop-driven rivets in reamed or drilled holes, 12,000. Shop-driven rivets in punched holes, 11,000. Field-driven rivets and turned bolts, 9,000. Plate girder webs, gross section, $12{,}000 - (40d \div t)$, where d is the minimum unsupported distance in inches, between the flange angles or stiffeners, whichever is the smaller, and t the thickness of web in inches. Pins, 12,000.

(20) *Bearing.*—Bearing, shop-driven rivets in reamed or drilled holes, 24,000. Shop-driven rivets in punched holes, 22,000. Field-driven rivets and turned bolts, 18,000. Pins, 24,000. Expansion rollers, per linear inch $600D$, where D is the diameter of the roller in inches. Granite masonry, 600. Sandstone and limestone, 300. Portland cement concrete, 400.

(21) *Alternate Strains.*—Members and their connections, subject to alternate tension and compression, shall be proportioned to resist either strain increased by an amount equal to 8/10 of the smaller strain.

(22) *Counters.*—Wherever the live and dead load strains are of opposite character, only 70 per cent. of the dead load strain shall be considered as effective in counteracting the live load strain.

(23) *Combined Strains.*—Members subject to the action of both axial and bending strains shall be proportioned so that the greatest fiber strain will not exceed the allowed limits for the axial tension or compression in that member.

(24) *Lateral Strains.*—For strains produced by lateral, longitudinal and wind forces, combined with vertical forces, the unit strains may be increased not to exceed 25 per cent. over those given above, but the sections shall not be less than required by the strains from the vertical forces without such increase.

(25) *Net Section at Rivets.*—In proportioning tension, the rivet holes shall be taken one-eighth inch larger than the diameter of the rivet before driving.

(26) *Rivets.*—In proportioning rivets, the diameter of the rivet before driving shall be used.

(27) *Net Section at Pins.*—Pin-connected riveted tension members shall have a net section through the pin-hole at least 25 per cent. in excess of the net section of the body of the member; and the net section back of the pin hole, parallel with the axis of the member, shall be not less than the net section of the body of the member.

(28) *Proportioning Plate Girders.*—Plate girders shall be proportioned either by the moment of inertia of their net section, or by assuming that the strains pass through the centers of gravity of flange sections, in which case one-eighth of the net section of the web, if properly spliced, may be used as flange section.

(29) *Compression Flange.*—The gross section of the compression flange shall not be less than the gross section of the tension flange, and the width of the flange shall not be less than one-twelfth of the distance between its side supports.

(30) *Flange Rivets.*—The flanges of plate girders shall be connected to the web with a sufficient number of rivets to transfer the total shear at any point in a distance equal to the depth of the girder at that point, and in addition any load applied directly on the flange. The wheel loads, where the ties rest on the flanges, shall be assumed to be distributed over three ties.

(31) *Web Stiffeners.*—Stiffeners shall be riveted to the web at all points of concentrated loads, and also at points required by the shear formula in paragraph 19. The stiffeners at bearings and other points, where they carry load directly, shall be connected to the web with a sufficient number of rivets to transmit the strain from the concentrated load, and shall be proportioned for this strain by the axial compression formula in paragraph 17. The effective length shall be assumed to be one-half the length of the stiffener. They shall, however, not be of smaller dimensions than specified in paragraph 82.

(32) *Rolled Beams.*—Rolled sections, used as beams, shall be proportioned by their moment of inertia. The width of flanges shall not be less than one-sixteenth of the distance between side supports.

(33) *Depth Ratios.*—Pony trusses and plate girders shall preferably have a depth not less than one-tenth of the span, and rolled beams and channels used as girders shall preferably have a depth of not less than one-twelfth of the span. When these ratios are decreased, proper increase shall be made to the flange sections.

IV, Details of Design; General Requirements.

(34) *Open Sections.*—Details shall be so designed that all parts will be accessible for inspection, cleaning, painting and repairs.

(35) *Water Pockets.*—Pockets or depressions which will hold water shall be provided with satisfactory drain holes, or be filled with acceptable waterproof material.

(36) *Symmetrical Sections.*—Main members shall be so designed that the neutral axis will be as near as practicable in the center of section, and the neutral axes of intersecting main members of trusses shall meet at a common point.

(37) *Adjustable Members.*—Adjustable members shall preferably be avoided, but when used for counters of pin-connected trusses, they shall be provided with open turnbuckles.

(38) *Strength of Connections.*—The strength of connections shall be sufficient to develop the full strength of the member, even though the computed strain is less, the kind of strain to which the member is subjected being considered.

(39) *Minimum Thickness.*—The minimum thickness of material shall be ⅜ in. for all parts carrying calculated strain and 5/16 in. for other parts. Fillers may be of any thickness.

(40) *Pitch of Rivets.*—The minimum distance between centers of rivet holes shall be three diameters of the rivet; but the distance shall preferably be not less than 3 in. for ⅞-in. rivets, and 2½-in. for ¾-in. rivets. The maximum pitch in the line of strain for members composed of plates and shapes shall be 6 in. for ⅞-in. rivets and 5 in. for ¾-in. rivets. For angles with two gage lines the maximum shall be twice the above in each line with rivets staggered, and where two or more plates are used in contact, rivets not more than 12 in. apart in any direction shall be used to hold the plates well together. In tension members composed of two angles in contact, a pitch of 12 in. will be allowed for riveting the angles together.

(41) *Edge Distance.*—The minimum distance from the center of any rivet hole to a sheared edge shall be 1½ in. for ⅞-in. rivets, and 1¼ in. for ¾-in. rivets, and to a rolled edge 1¼ and 1⅛ in., respectively. The maximum distance from any edge shall be eight times the thickness of the plate, but shall not exceed 6 in.

(42) *Maximum Diameter.*—The diameter of the rivets in any angle carrying calculated strain shall not exceed one-quarter the width of the leg in which they are driven. In minor parts ⅞-in. rivets may be used in 3-in. angles, and ¾-in. rivets in 2½-in. angles.

(43) *Long Rivets.*—Rivets carrying calculated strain and whose grip exceeds four diameters shall be increased in number at least 1 per cent. for each additional 1/16-in. grip.

(44) *Pitch at Ends.*—The pitch of rivets at the ends of built compression members shall not exceed four diameters of the rivets for a length equal to one and one-half times the maximum width of member.

(45) *Compression Members.*—In compression members the metal shall be concentrated principally in vertical webs and flange angles. The thickness of these webs shall not be less than 1/30 of the distance between the lines of rivets connecting them to the flanges; and any cover plate shall be as thin as possible, but not less than 1/40 of the distance between the rivet lines.

(46) *Minimum Angles.*—Angles used as flanges of girders or chord sections of trusses without cover plates shall have a minimum thickness of 1/10 the width of the outstanding leg.

(47) *Tie Plates.*—The open sides of compression members shall be provided with lattice, and shall have tie plates as near each end as practicable. Tie plates shall be provided at intermediate points where the lattice is interrupted. In main members, carrying calculated strain, the end tie-plates shall have a length not less than the distance between the lines of rivets connecting them to the flanges, and intermediate ones not less than half this distance. Their thickness shall not be less than 1/50 of the same distance.

(48) *Lattice.*—The minimum width of lattice bars shall be 2½ in. for ⅞-in. rivets, 2¼ in.

for ¾-in. rivets, and 2 in. if ⅝-in. rivets are used. The thickness shall not be less than 1/40 of the distance between end rivets, for single lattice, and 1/60 for double lattice. Shapes of equivalent strength may be used.

(49) *Rivets in Flanges.*—Five-eighths-inch rivets shall be used for latticing flanges less than 2½ in. wide and ¾-in. rivets for flanges from 2½ to 3½ in. wide; ⅞-in. rivets shall be used in flanges 3½ in. and over, and lattice bars with two rivets shall be used for flanges over 5 in. wide.

(50) *Angle of Lattice.*—The inclination of lattice bars with the axis of the member shall not be less than 45 degrees, and when the distance between rivet lines in the flanges is more than 15 in., if single rivet bar is used, the lattice shall be double and riveted at the intersection.

(51) *Spacing of Lattice.*—The pitch of lattice connections along the flange divided by the radius of gyration of the flange angle about an axis through its center of gravity, perpendicular to the plane of the lattice, shall be less than the corresponding ratio of the member as a whole.

(52) *Faced Joints.*—Abutting joints in compression members when faced for bearing shall be spliced on four sides sufficiently to hold the connecting members accurately in place. All other joints in riveted work, whether in tension or compression, shall be fully spliced.

(53) *Pin Plates.*—Pin holes shall be reinforced by plates where necessary, and at least one plate shall be as wide as the flanges will allow and be on the same side as the angles. They shall contain sufficient rivets to distribute their portion of the pin pressure to the full cross-section of the member.

(54) *Forked Ends.*—Forked ends on compression members will be permitted only where unavoidable; where used, a sufficient number of pin plates shall be provided to make the jaws of twice the sectional area of the member. At least one of these plates shall extend to the far edge of the farthest tie-plate and the balance not less than 6 in. beyond the near edge of the same plate.

(55) *Pins.*—Pins shall be long enough to insure a full bearing of all the parts connected upon the turned body of the pin. They shall be secured by chambered nuts or be provided with washers if solid nuts are used. The screw ends shall be long enough to admit of burring the ends.

(56) *Filling Rings.*—Members packed on pins shall be held against lateral movement.

(57) *Bolts.*—Where members are connected by bolts, the turned body of these bolts shall be long enough to extend through the metal. A washer at least ¼ in. thick shall be used under the nut. Bolts shall not be used in place of rivets, except by special permission. Heads and nuts shall be hexagonal.

(58) *Indirect Splices.*—Where splice plates are not in direct contact with the parts which they connect, rivets shall be used on each side of the joint in excess of the number theoretically required to the extent of 1/3 of the number for each intervening plate.

(59) *Fillers.*—The number of rivets in fillers between parts carrying strain shall be governed by paragraph 58; the excess rivets, where possible, to be outside of the connected part, so as to make tight fillers.

(60) *Expansion.*—Provision for expansion to the extent of one inch for each 100 ft. shall be made for all bridge structures.

(61) *Expansion Bearings.*—Truss bridges and plate girders over 80-ft. span shall rest on turned rollers or rockers at one end, and plate girders of all other spans shall be arranged to slide on smooth surfaces. The bearings of viaduct towers shall be arranged to allow for temperature movement to the amount called for by paragraph 60.

(62) *Fixed Bearings.*—Movable bearings shall be designed to permit motion in one direction only. Fixed bearings shall be firmly anchored to the masonry.

(63) *Rollers.*—Expansion rollers shall be not less than 4 in. in diameter. They shall be coupled together with substantial side bars, which shall be so arranged that the rollers can be readily cleaned.

(64) *Bolsters.*—Bolsters or shoes shall be so constructed that the load will be well distributed over the entire bearing, and all spans over 80 ft. shall preferably have hinged bolsters at each end.

(65) *Wall Plates.*—Wall plates may be cast or built up. They shall be so designed as to distribute the load equally over the entire bearing.

(66) *Stone Bolts.*—Wall plates shall be securely anchored to the masonry against displacement.

(67) *Anchorage.*—Anchor bolts for viaduct towers and similar structures shall be long enough to engage a mass of masonry the weight of which is at least one and one-half times the calculated tensile strain on the anchor.

(68) *Inclined Bearings.*—Bridges on an inclined grade without pin shoes shall have the sole plates beveled so that the masonry and expansion surfaces may be level.

(69) *Imperfect Bearings.*—If wall plates do not get a full bearing on the masonry, the deficiency shall be made good with rust cement or Portland cement mortar.

V, Floor System.

(70) *Floor Beams.*—Floor beams shall preferably be square to the trusses or girders. They shall be riveted directly to the girders or trusses or may be placed on top of deck bridges.

(71) *Stringers.*—Stringers shall preferably be riveted to the webs of all intermediate floor beams by means of connection angles not less than 7/16 in. thick. Shelf angles or other supports provided to support the stringer during erection shall not be considered as carrying any of the reaction.

(72) *End Spacers for Stringers.*—Where end floor beams are not used, stringers resting on masonry shall have cross frames near their ends. These frames shall be riveted to girders or truss shoes where practicable.

VI, Bracing.

(73) *Rigid Bracing.*—Lateral, longitudinal and transverse bracing in all structures shall be composed of rigid members.

(74) *Portals.*—Through truss bridges shall have riveted portal braces rigidly connected to end posts and top chords. They shall be as deep as the clearance will allow.

(75) *Overhead Transverse Bracing.*—Intermediate transverse frames shall be used at each panel of through bridges having vertical truss members where the clearance will permit.

(76) *End Bracing.*—Deck bridges shall have transverse bracing at each end proportioned to carry the lateral load to the support.

(77) *Style of Bracing.*—Each panel of bracing shall preferably consist of two intersecting members, securely riveted at their intersection.

(78) *Minimum Bracing.*—The minimum sized angle to be used in lateral bracing shall be 3½ by 3 by ⅜ in. Not less than 4 rivets through the ends of the angles shall be used at the connections.

(79) *Bracing to Clear Ties.*—Lateral bracing in deck spans shall be far enough below the flanges so that the ties cannot by any possibility rest on it.

(80) *Tower Struts.*—The horizontal struts at the foot of viaduct towers shall be strong enough in compression to slide the movable shoes when the track is unloaded.

VII, Plate Girders.

(81) *Top Flange Cover.*—Where flange plates are used, one cover plate of top flange shall extend the whole length of the girder.

(80) *Web Stiffeners.*—Web stiffeners shall be in pairs. Those over the end bearings shall be on fillers, the outstanding legs shall be as wide as the flange angles will allow, and they shall be brought to a close bearing against the upper and lower flange angles. Intermediate stiffeners may be on fillers or offset over the flange angles. Their outstanding legs shall not be less than 1/30 of the depth of the girder plus 2 in. The thickness of all stiffeners shall not be less than ⅜ in. and the rivet pitch in them shall be not over 5 in.

(83) *Stays for Top Flanges.*—Through plate girders shall have their top flanges stayed at each end of every floor beam, or in case of solid floors, at distances not exceeding 12 ft., by knee braces or gusset plates.

VIII, Trusses.

(84) *Camber.*—Truss bridges shall be given a camber by making the panel length of the top chords, or their horizontal projections, longer than the corresponding panels of the bottom chord in the proportion of ⅛ in. in 10 ft.

(85) *Rigid Members.*—The hip verticals of through trusses, and generally the two end panels of bottom chords of pin trusses, shall be rigid members.

(86) *Eye-bars.*—The eye-bars composing a member shall be so arranged that adjacent bars shall not have their surfaces in contact; they shall be as nearly parallel to the axis of the truss as posible, the maximum inclination of any bar being limited to 1 in. in 16 ft.

(87) *Pony Trusses.*—Pony trusses shall be riveted structures and shall have all web members latticed or otherwise effectively stiffened.

IX, Viaducts and Trestles.

(88) *Rigid Members.*—Viaducts and trestles shall be riveted structures, with no adjustable members.

(89) *Expansion.*—Expansion joints shall be provided at frequent intervals so as to prevent the concentration of excessive motion in the floor and track connections. At those points the free girders shall be secured against displacement sideways by substantial guides. Excessive longitudinal motion shall be prevented by effective connections.

PART SECOND—MATERIALS AND WORKMANSHIP.

(Note.—Part Second.—Materials and Workmanship, was formally adopted.)

X, Material.

(90) *Process of Manufacture.*—Steel shall be made by the open-hearth process.

(91) *Schedule of Requirements.*—The chemical and physical properties shall conform to the following limits (Table I):

TABLE I.—REQUIRED CHEMICAL AND PHYSICAL PROPERTIES.

Elements Considered.	*Structural Steel.*	*Rivet Steel.*	*Steel C*
Phosphorus, max.. Basic	0.04 per cent.	0.04 per cent.	0.05 pe
Phosphorus, max.. Acid	0.08 per cent.	0.04 per cent.	0.08 pe
Sulphur, maximum	0.05 per cent.	0.04 per cent.	0.05 pe
Ultimate tensile strength.	Desired	Desired	Not le
Pounds per sq. inch..............	60,000	50,000	65,
Elong., min. % in 8", Fig. 1....	1,500,000* Ult. tensile strength.	1,500,000 Ult. tensile strength.	
Elong., min. % in 2", Fig. 2.......	22		
Character of Fracture...........	Silky.	Silky.	Silky or
Cold Bends without Fracture......	180° flat.†	180° flat.‡	

*See paragraph 101. †See paragraphs 102, 103 and 104. ‡See paragraph 105.

The yield point, as indicated by the drop of beam, shall be recorded in the test reports.

(92) *Allowable Variations.*—If the ultimate strength varies more than 4,000 lb. from that desired, a retest shall be made on the same gage, which, to be acceptable, shall be within 5,000 lb. of the desired ultimate.

(93) *Chemical Analyses.*—Chemical determinations of the percentages of carbon, phosphorus, sulphur and manganese shall be made by the manufacturer from a test ingot taken at the time of the pouring of each melt of steel, and a correct copy of such analysis shall be furnished to the engineer or his inspector. Check analyses shall be made from finished material, if called for by the purchaser, in which case an excess of 25 per cent. above the required limits will be allowed.

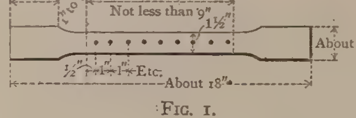


FIG. 1.

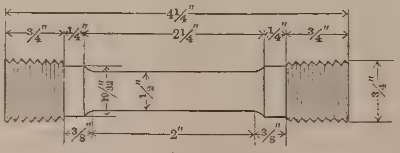


FIG. 2.

XI, Plates, Shapes and Bars.

(94) *Forms of Specimens.*—Specimens for tensile and bending tests for plates, shapes and bars shall be made by cutting coupons from the finished product, which shall have both faces rolled and both edges milled to the form shown by Fig. 1; or with both edges parallel; or they may be turned to a diameter of ¾ in. for a length of at least 9 in., with enlarged ends.

(95) *Rivets.*—Rivet rods shall be tested as rolled.

(96) *Pins and Rollers.*—Specimens shall be cut from the finished or rolled or forged bar, in such manner that the center of the specimen shall be one inch from the surface of the bar. The specimen for tensile test shall be turned to the form shown by Fig. 2. The specimen for bending test shall be 1 in. by ½ in. in section.

(97) *Steel Castings.*—The number of tests will depend on the character and importance of the castings. Specimens shall be cut cold from coupons molded and cast on some portion of one or more castings from each melt or from the sink heads, if the heads are of sufficient size. The coupon or sink head, so used, shall be annealed with the casting before it is cut off. Test specimens to be of the form prescribed for pins and rollers.

(98) *Annealed Specimens.*—Material which is to be used without annealing or further treatment shall be tested in the condition in which it comes from the rolls. When material is to be annealed, or otherwise treated befor
specimens for tensile tests representin
terial shall be cut from properly a
similarly treated short lengths of th
tion of the bar.

(99) *Number of Tests.*—At least
and one bending test shall be made
melt of steel as rolled. In case ste
⅜ in. and more in thickness is rolle
melt, a test shall be made from the t
thinnest material rolled.

(100) *Modifications in Elongation.*
terial less than 5/16 in., and more tha
thickness the following modifications
lowed in the requirements for elong

(a) For each 1/16 in. in thick
5/16 in., a deduction of 2½ will
from the specified percentage.

(b) For each ⅛ in. in thickness ab
a deduction of 1 will be allowed from
fied percentage.

(c) For pins and rollers over 3 in. i
the elongation in 8 in. may be 5 per
than that specified in paragraph 92.

(101) *Bending Tests.*—Bending tes
made by pressure or by blows. Plates,
bars less than 1 in. thick shall bend as
in paragraph 92.

(102) *Thick Material.*—Full sized m
eye-bars and other steel 1 in. thick
tested as rolled, shall bend cold 18
around a pin, the diameter of which i
twice the thickness of the bar, withou
on the outside of bend.

(103) *Bending Angles.*—Angles ¾ i
in thickness shall open flat, and ang
and less in thickness shall bend shut,
der blows of a hammer, without sign o
This test will be made only when re
the inspector.

(104) *Nicked Bends.*—Rivet steel, wh
and bent around a bar of the same d
the rivet rod, shall give a gradual br
fine, silky, uniform fracture.

(105) *Finish.*—Finished material sha
from injurious seams, flaws, cracks,
edges or other defects, and have a sm
form and workmanlike finish. Plates
width and under shall have rolled edg

(106) *Stamping.*—Every finished piec
shall have the melt number and the na
manufacturer stamped or rolled upon
for pins and rollers shall be stamped or
Rivet and lattice steel and other small
be bundled with the above marks on an
metal tag.

(107) *Defective Material.*—Material
subsequent to the above tests at the
its acceptance there, develops weak sp
tleness, cracks or other imperfections, or
to have injurious defects, will be reject
shop and shall be replaced by the man
at his own cost.

(108) *Allowable Variation in Weigh*
riation in cross-section or weight of each
steel of more than 2½ per cent. from
cified will be sufficient cause for rejec
cept in case of sheared plates, which wi
ered by the following permissible v
which are to apply to single plates:

(109) *When Ordered to Weight.*—Pl
lb. per square foot or heavier:

TABLE II.—ALLOWABLE EXCESS WEIGHTS IN PLATES.

Thickness Ordered.	Nominal Weights.	Width of Plate. Up to 75".	75" and up to 100".	100" and up to 115".	Ov
¼-inch	10.20 lbs.	10 per cent.	14 per cent.	18 per cent.	..
5/16-inch	12.75 lbs.	8 per cent.	12 per cent.	16 per cent.	..
⅜-inch	15.30 lbs.	7 per cent.	10 per cent.	13 per cent.	17
7/16-inch	17.85 lbs.	6 per cent.	8 per cent.	10 per cent.	13
½-inch	20.40 lbs.	5 per cent.	7 per cent.	9 per cent.	12
9/16-inch	22.95 lbs.	4½ per cent.	6½ per cent.	8½ per cent.	11
⅝-inch	25.50 lbs.	4 per cent.	6 per cent.	8 per cent.	10
Over ⅝-inch	....	3½ per cent.	5 per cent.	6½ per cent.	9

(a) Up to 100 in. wide, 2½ per cen
or below the prescribed weight.

(b) One hundred inches wide and
per cent. above or below.

(110) *Plates under 12½ lb. per squa*

(a) Up to 75 in. wide, 2½ per cent.
below.

(b) Seventy-five inches and up to 100
5 per cent. above or 3 per cent. below

(c) One hundred inches wide and over

ıbove or 3 per cent. below.
) *When Ordered to Gage.*—Plates will be
ed if they measure not more than .01 in.
the ordered thickness.
·) *Excess Weight.*—An excess over the
al weight, corresponding to the dimensions
: order, will be allowed for each plate, if
ıore than that shown in the accompanying
(Table II), 1 cu. in. of rolled steel be-
sumed to weight 0.2833 lb.:

XII, Special Metals.

3) *Cast Iron.*—Except where chilled iron
cified, castings shall be made of tough gray
with sulphur not over 0.10 per cent. They
be true to pattern, out of wind and free
flaws and excessive shrinkage. If tests are
ıded, they shall be made on the "Arbitra-
3ar" of the American Society for Testing
ials, which is a round bar, 1¼ in. diame-
nd 15 in. long. The transverse test shall
ıde on a supported length of 12 in. with
t middle. The minimum breaking load so
d shall be 29,000 lb., with a deflection of
st 1/10 in. before rupture.
ı) *Wrought Iron Bars.*—Wrought iron shall
uble rolled, tough, fibrous and uniform in
ter. It shall be thoroughly welded in roll-
nd be free from surface defects. When
in specimens of the form of Fig. 1, or in
ized pieces of the same length, it shall
an ultimate strength of at least 50,000 lb.
quare inch, an elongation of at least 18
nt. in 8 in., with fracture wholly fibrous.
nens shall bend cold, with the fiber, through
g., without sign of fracture, around a pin
ımeter of which is not over twice the thick-
f the piece tested. When nicked and bent,
racture shall show at least 90 per cent.

I, Inspection and Testing at the Mills.

) *Copies of Mill Orders.*—The purchaser
e furnished with complete copies of mill
, and no material shall be rolled, nor work
before the purchaser has been notified
the orders have been placed, so that he
rrange for the inspection.
) *Facilities for Inspection.*—The manufac-
shall furnish all facilities for inspecting
sting the weight and quality of all material
mill where it is manufactured. He shall
a suitable testing machine for testing the
ens, as well as prepare the pieces for the
e, free of cost.
) *Access to Mills.*—When an inspector is
ed by the purchaser to inspect material
mills, he shall have full access, at all
to all parts of mills where material to be
ed by him is being manufactured.

XIV, Workmanship.

) *General.*—All parts forming a structure
e built in accordance with approved draw-
The workmanship and finish shall be
to the best practice in modern bridge

) *Straightening Material.*—Material shall
oughly straightened in the shop, by meth-
t will not injure it, before being laid off
ked in any way.
) *Finish.*—Shearing shall be neatly and
ely done, and all portions of the work
to view neatly finished.
Size of Rivets.—The size of rivets, called
the plans, shall be understood to mean
ual size of the cold rivet before heating.
Rivet Holes.—When general reaming is
uired, the diameter of the punch for ma-
ot over ⅝-in. thick shall be not more than
greater than that of the rivet. The
r of the die shall not exceed that of the
y more than ¼ the thickness of the metal
l. Material over ⅝-in. thick, except
details, and all material where general
is required, shall be sub-punched and
as per paragraph 152, or drilled from
d. Holes in flanges of rolled beams and
s used in floors of railroad bridges shall
ed from the solid. Those in webs of
hall be so drilled or sub-punched and

Punching.—Punching shall be accurate-
Slight inaccuracy in the matching of
ay be corrected with reamers. Drifting
rge unfair holes will not be allowed.
atching of holes will be cause for rejec-
the option of the inspector.
Assembling.—Riveted members shall
parts well pinned up and firmly drawn
with bolts before riveting is commenced.
surfaces to be painted (see paragraph

Lattice Bars.—Lattice bars shall have
ounded ends, unless otherwise called for.
Web Stiffeners.—Stiffeners shall fit neat-
een flanges of girders. Where tight fits
ed for, the ends of the stiffeners shall be
nd shall be brought to a true contact
with the flange angles.

(127) *Splice Plates and Fillers.*—Web splice plates and fillers under stiffeners shall be cut to fit within ⅛ in. of flange angles.

(128) *Web Plates.*—Web plates of girders, which have no cover plates, shall be flush with the backs of angles or project above the same not more than ⅛ in., unless otherwise called for. When web plates are spliced, not more than ¼-in. clearance between ends of plates will be allowed.

(129) *Connection Angles.*—Connection angles for floor girders shall be flush wtih each other and correct as to position and length of girder. In case milling is required after riveting, the removal of more than 1/16 in. from their thickness will be cause for rejection.

(130) *Riveting.*—Rivets shall be driven by pressure tools wherever possible. Pneumatic hammers shall be used in preference to hand driving.

(131) *Rivets.*—Rivets shall look neat and finished, with heads of approved shape, full and of equal size. They shall be central on shank and grip the assembled pieces firmly. Recupping and calking will not be allowed. Loose, burned or otherwise defective rivets shall be cut out and replaced. In cutting out rivets, great care shall be taken not to injure the adjacent metal. If necessary, they shall be drilled out.

(132) *Turned Bolts.*—Wherever bolts are used in place of rivets which transmit shear, the holes shall be reamed parallel, and the bolts turned to a driving fit. A washer not less than ¼-in. thick shall be used under nut.

(133) *Members to be Straight.*—The several pieces forming one built member shall be straight and fit closely together, and finished members shall be free from twists, bends or open joints.

(134) *Finish of Joints.*—Abutting joints shall be cut or dressed true and straight, and fitted close together, especially where open to view. In compression joints depending on contact bearing, the surfaces shall be truly faced, so as to have even bearings after they are riveted up complete and when perfectly aligned.

(135) *Field Connections.*—Holes for floor girder connections shall be sub-punched and reamed with twist drills to a steel templet 1 in. thick. Unless otherwise allowed, all other field connections shall be assembled in the shop and the unfair holes reamed; and when so reamed the pieces shall be match-marked before being taken apart.

(136) *Eye-Bars.*—Eye-bars shall be straight and true to size, and shall be free from twists, folds in the neck or head, or any other defect. Heads shall be made by upsetting, rolling or forging. Welding will not be allowed. The form of heads will be determined by the dies in use at the works where the eye-bars are made, if satisfactory to the engineer, but the manufacturer shall guarantee the bars to break in the body with a silky fracture, when tested to rupture. The thickness of head and neck shall not vary more than 1/16 in. from the thickness of the bar.

(137) *Boring Eye-Bars.*—Before boring, each eye-bar shall be properly annealed and carefully straightened. Pin holes shall be in the center line of bars and in the center of heads. Bars of the same length shall be bored so accurately that, when placed together, pins 1/32 in. smaller in diameter than the pin holes can be passed through the holes at both ends of the bars at the same time.

(138) *Pin Holes.*—Pin holes shall be bored true to gages, smooth and straight; at right angles to the axis of the member and parallel to each other, unless otherwise called for. Wherever possible, the boring shall be done after the member is riveted up.

(139) *Variation in Pin Holes.*—The distance center to center of pin holes shall be correct within 1/32 in., and the diameter of the hole not more than 1/50 in. larger than that of the pin, for pins up to 5-in. diameter, and 1/32 in. for larger pins.

(140) *Pins and Rollers.*—Pins and rollers shall be accurately turned to gage, and shall be straight and smooth and entirely free from flaws.

(141) *Pilot Nuts.*—At least one pilot and driving nut shall be furnished for each size of pin for each structure, and field rivets to the amount of 10 per cent. in excess of the number of each size actually required.

(142) *Screw Threads.*—Screw threads shall make tight fits in the nuts, and shall be U. S. standard, except above the diameter of 1⅜ in., when they shall be made with six threads per inch.

(143) *Annealing.*—Steel, except in minor details, which has been partially heated, shall be properly annealed.

(144) *Steel Castings.*—All steel castings shall be annealed.

(145) *Welds.*—Welds in steel will not be allowed.

(146) *Bed Plates.*—Expansion bed plates shall be planed true and smooth. Cast wall plates shall be planed top and bottom. The cut of the planing tool shall correspond with the direction of expansion.

(147) *Shipping Details.*—Pins, nuts, bolts, rivets and other small details shall be boxed or crated.

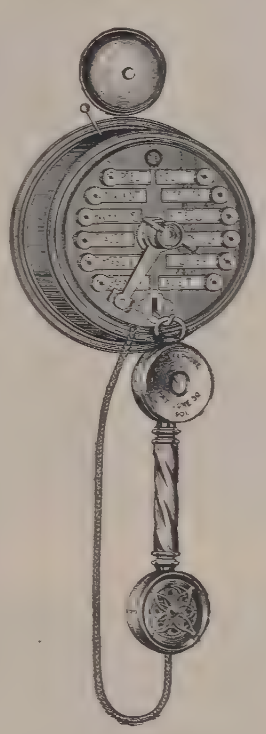
(148) *Weight.*—The weight of every piece and box shall be marked on it in plain figures.

(149) *Finished Weight.*—Payment for pound price contracts shall be by scale weight. No allowance over 2 per cent. of the total weight of the structure as computed from the plans will be allowed for excess weight.

XV, Additional Specifications When General Reaming and Planing are Reuired.

(150) *Planing Edges.*—Sheared edges and ends shall be planed off at least ¼ in.

(151) *Reaming.*—Punched holes shall be made with a punch 3/16 in. smaller in diameter than the nominal size of the rivets, and shall be reamed to a finished diameter of not more than 1/16 in. larger than the rivet.



A SHOP TELEPHONE.

(152) *Reaming after Assembling.*—Wherever practicable, reaming shall be done after the pieces forming one built member have been assembled and firmly bolted together. If necessary to take the pieces apart for shipping and handling, the respective pieces reamed together shall be so marked that they may be reassembled in the same position in the final setting up. No interchange of reamed parts will be allowed.

(153) *Removing Burrs.*—The burrs on all reamed holes shall be removed by a tool countersinking about 1/16 in.

XVI, Shop Painting.

(154) *Cleaning.*—Steel work, before leaving the shop, shall be thoroughly cleaned and given one good coating of pure linseed oil, or such paint as may be called for, well worked into all joints and open spaces.

(155) *Contact Surfaces.*—In riveted work, the surfaces coming in contact shall each be painted before being riveted together.

(156) *Inaccessible Surfaces.*—Pieces and parts which are not accessible for painting after erection, including tops of stringers, eye-bar heads, ends of posts and chords, etc., shall have a good coat of paint before leaving the shop.

(157) *Condition of Surfaces.*—Painting shall be done only when the surface of the metal is perfectly dry. It shall not be done in wet or freezing weather, unles protected under cover.

(158) *Machine Finished Surfaces.*—Machine-finished surfaces shall be coated with white lead and tallow before shipment or before being put out into the open air.

XVI, Inspection and Testing at the Shops.

(159) *Facilities for Inspection.*—The manufacturer shall furnish all facilities for inspecting and testing the weight and the quality of workmanship at the shop where material is manufactured. He shall furnish a suitable testing machine for testing full-sized members if required.

(160) *Starting Work in Shop.*—The purchaser shall be furnished complete shop plans, and must be notified well in advance of the start of the work in the shop, in order that he may have an inspector on hand to inspect material and workmanship. Complete copies of shipping invoices shall be furnished to the purchaser with each shipment.

(161) *Access to Shop.*—When an inspector is furnished by the purchaser, he shall have full access, at all times, to all parts of the shop where material under his inspection is being manufactured.

(162) *Accepting Material or Work.*—The inspector shall stamp each piece accepted with a private mark. Any piece not so marked may be rejected at any time, and at any stage of the work. If the inspector, through an oversight or otherwise, has accepted material or work which is defective or contrary to the specifications, this material, no matter in what stage of completion, may be rejected by the purchaser.

XVII, Full-Size Tests.

(163) *Test to Prove Workmanship and Design.*—Full-size parts of structures shall be tested by the manufacturer if required by the purchaser. Such tests on eye-bars and similar members, to prove the workmanship, shall be made at the manufacturer's expense, and shall be paid for by the purchaser, at contract, if the tests are satisfactory. If the tests are not satisfactory, the members represented by them will be rejected. The expense of testing members, to prove their design, shall be paid for by the purchaser.

(164) *Eye-Bars.*—In eye-bar tests the ultimate strength, true elastic limit and the elongation in 10 ft., unless a different length is called for, shall be recorded, but in no case will eye-bars be accepted if the ultimate strength falls below 55,000 lb., or the elastic limit below 50 per cent. of the ultimate.

(165) *Transverse Tests.*—In transverse tests the lateral and vertical deflections shall be recorded.

TELEPHONES FOR INDUSTRIAL WORKS.

The editorial discussion of the value of telephones between departments of an industrial establishment, which was printed in this journal on March 18, has apparently expressed the opinion of numerous shop managers. The slow development of this feature of telephone work can be readily explained by the lack of information concerning suitable equipment which has reached these men. The prevalent idea seems to be that it is necessary to put in expensive switchboards and gum-chewing operators for even a very moderate installation. This idea is entirely wrong.

Where it is necessary to call up not more than 20 stations, the Metaphone system offers a simple solution of the problem, without the use of central switchboard or operator. The makers of the apparatus, the Electric Utilities Co., 23d St. and Broadway, New York, supply two types. The first is the intercommunicating system, in which each of the stations can be connected by the person using it with any other. The instruments are very simple in form, and are made for attachment to a wall or for use on a desk. The wall instrument shown in the illustration is arranged for conversation with twelve stations. The receiver and transmitter are mounted on opposite ends of a short metal handle, which is suspended when not in use from a movable hanger in a small cylindrical box. On the box is mounted a switch lever to connect with as many contact points as there are outlying stations. When the handle is taken from the hook and the lever moved to the desired contact point, it is only necessary to press the button at the top of the instrument to ring up the station with which it is desired to talk. When the handle carrying the receiver and transmitter is hung on the hook, the switch lever is automatically restored to its initial position.

It sometimes happens that the only use of the telephones is to connect a number of outlying stations with the main office. In this case the main station equipment is the same as before, but at each sub-station there is only a simple instrument consisting of the transmitter and receiver mounted on a handle, a push-button and a call bell. In many establishments, a system of call bells has been introduced, and the Metaphone instruments can be attached directly to this wiring without any change or interference with the calls. Under such conditions the installation of a telephone system is a very simple and inexpensive piece of work.

The Tropenas converter process of making steel for steel castings is described at length in a booklet issued by Powell & Colnè, 11 Broadway, New York, agents for the process in North and South America.

PERSONAL NOTES.

Mr. Jas. Cameron, a prominent railroad contractor, has been elected mayor of Keokuk, Ia.

Mr. John A. Jones has been re-elected city engineer of Lewiston, Me.

Mr. Robert Hooke has been reappointed city engineer of Chattanooga, Tenn.

Mr. R. G. Hengst has been appointed assistant chief engineer of the Western Allegheny Ry., with headquarters at New Castle, Pa.

Mr. S. M. Allis, of Boston, Mass., has just returned from a three months' trip in Nicaragua examining mining prospects for New England capitalists.

Mr. Clarence G. Norris, formerly engineer of the sewer board and superintendent of streets, has been appointed town engineer of Hyde Park, Mass., a new position.

Mr. James Dempsey has resigned his position with the American Bridge Co. at Elmira, N. Y., to become inspecting bridge engineer on the Erie R. R.

Mr. B. J. Dalton has resigned as city engineer of Lawrence, Kan., to accept a position in railroad work and Mr. E. E. Trueblood will complete Mr. Dalton's term of office.

Mr. E. H. Baldwin, constructing engineer in the U. S. Reclamation Service, has reported to Mr. C. E. Wells at Casper, Wyo., where he will be engaged on the Pathfinder reservoir.

Mr. W. B. Fuller has been engaged by T. A. Gillespie & Co. as chief engineer of their work on the construction of the Pittsburg filtration plant.

Prof. W. K. Hatt, of Purdue University, recently delivered a lecture on "Structural Timber in Relation to Substitutes Therefor," before the students of the Yale Forest School.

Mr. T. T. Lyman has been appointed general sales manager of the H. W. Johns-Manville Co., of New York, and will have charge of the installation of various systems in connection with the branch offices of the company.

Mr. F. W. Huber, assistant engineer in the U. S. Reclamation Service, has been transferred from Berkeley, Cal., to Hazen, Nev., and will conduct cement tests under the direction of Mr. L. H. Taylor.

Mr. Geo. A. McCarthy, assistant engineer of the Canadian Niagara Falls Power Co., has been appointed assistant to Mr. W. B. Russell, chief engineer of the Temiskaming & Northern Ontario Ry.

Mr. H. G. Field, president of Field, Hinchman & Smith, engineers and architects, Detroit, Mich., has become connected with the Buick Motor Co., of Flint and Jackson, Mich., but will retain his interest in the Detroit firm.

Mr. H. F. Shipley has been appointed assistant city engineer of Cincinnati, O., to succeed Mr. Hugh L. Conway, who has been appointed superintendent of track elevation and subways. Mr. Shipley will have charge of sewer work.

Mr. Lewis R. Britton has been elected general manager of the Milford Pink Granite Co., which was recently formed by merging the quarry interests of Norcross Bros., Milford Pink Granite Co., and Cutting & Co. at Milford, Mass.

Mr. A. P. Storer has been appointed irrigation investigating engineer of Oregon by the U. S. Department of Agriculture, and will carry on work under the direction of Mr. Elwood Mead.

Mr. H. W. Baker, resident engineer on the main line reconstruction work which, the Big Four Ry. has been carrying on in Illinois, has resigned to accept a position in the engineering department of the Chicago & Northwestern Ry.

Mr. A. C. Hezlep, engineer of maintenance of way on the Wheeling & Lake Erie Ry., has been appointed engineer of maintenance of way of the Pittsburg-Wabash Ry., in addition to his present position.

In the article on the plant of the Edison Electric Co., of Los Angeles, which appeared in this journal on March 18, the name of the chief hydraulic engineer was incorrectly given as F. E. Finkle it should have been F. C. Finkle.

Mr. Ernest Adam, engineer of the street department of Newark, N. J., has been compelled by ill-health to resign. He has been connected with the municipal engineering departments of Newark for 39 years, and his work is well and favorably known among those who are in touch with public construction.

Mr. W. W. Crosby has been elected chief engineer of the highway commission of the Maryland State Geological Survey to succeed Mr. A. N. Johnson, who recently resigned to become highway engineer of the Office of Public Roads, U. S. Department of Agriculture.

Mr. J. B. Emerson, of the engineering department of the St. Louis, Iron Mountain & Southern Ry., has been assigned to the central division of that road, with headquarters a Buren, Ark. Mr. M. A. Hansen, assista gineer on the same road, has been app engineer of river protection on that road headquarters at St. Louis.

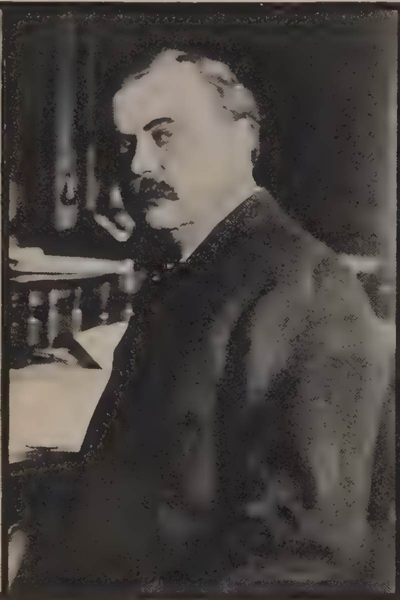
Mr. Henry C. Stiff has been appointed draftsman of the Moxham plant of the Steel Co. Mr. Stiff has been an assista Chief Engineer Entwisle for the past five and has had considerable experience in railway work.

Mr. M. H. Bronsdon has been appointed engineer of the United Railroads of San cisco. He began street railway work as chinist on the Los Angeles cable road. In he became superintendent and master mec of a Denver line, and later held a similar tion at Providence. About a year ago he be mechanical engineer of the Old Colony s in Massachusetts.

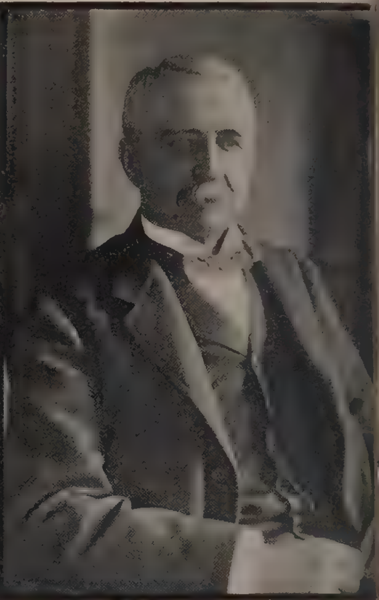
Mr. W. W. Macon, who was for several yea a member of the editorial staff of this journa has resigned to become editor of the "Met Worker, Plumber and Steam Fitter." His goo work in this office, particularly in the line heating and ventilation, makes his selection his new duties one which the readers of the journal will find it to their decided advantage.

Mr. H. C. Hurd has resigned as assistant gineer in the U. S. Reclamation Service to cept a position with the Peruvian Government Mr. A. I. Stiles, engineering aid in the Ser vice, has also resigned to accept a position the same government. Mr. Hurd will be suc ceeded at Roswell, N. M., by Mr. H. T. Pate son, assistant engineer in the Service, who h been transferred from Hazen, Nev.

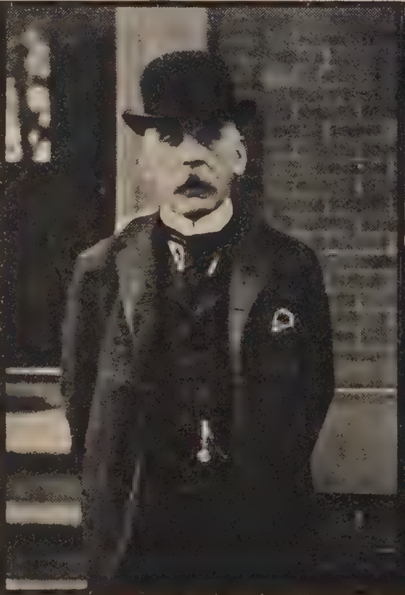
T. P. SHONTS, CHAIRMAN.

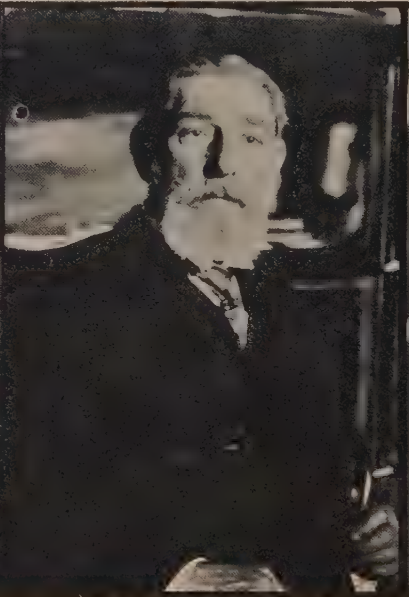

CHARLES E. MAGOON, GOVERNOR.

JOHN F. WALLACE, CHIEF ENGINEER.


BRIG. GEN. PETER C. HAINS.

REAR ADMIRAL M. T. ENDICOTT.


COL. OSWALD H. ERNST.


MAJOR B. M. HARROD.

D. T. MURPHY, SECY.

The Members and Secretary of the New Isthmian Canal Commission.

NTRACTING NEWS
OF SPECIAL INTEREST TO
TRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS
GINEERING AND BUILDING SUPPLIES.

WATER.

es Arranged Alphabetically by States.

on, Ariz.—Thos. Conlon, Supt. Water is reported to have submitted estimates to Freeman, Chmn Citizens' Com., for im- ients to waterworks. It is stated that the f improvements necessary without reser- or meters, $68,000; cost with duplicate of standpipe, $82,000; cost with a 1,000,000- servoir north of town, $112,000; cost with oo-gal. reservoir on mountain, $117,000; meters, $11,200; cost of completely pip- e city without meters, standpipes or de- ig work, $183,000.

cott, Ariz.—E. B. Moden, City Clk., that the date of opening of bids for fur- a water pump of capacity of 350 gals. in.; a 200 h. p. boiler and setting, and a p. Corliss steam turbine or internal com- steam engine, etc., has been extended Apr. 3 to Apr. 17.

ange, Cal.—The S. C. Smith Machinery Co. orted to have secured the contract for fur- g a tank, tower, engine, pump, pipe and s for the water works for about $9,890.

Angeles, Cal.—J. B. Lippincott is stated ve been appointed by the Los Angeles Comn. to assist Wm. Mulholland, Supt. ater Wks., in preparing a report on the ble water supply for Los Angeles.

ta Monica, Cal.—The Irwin Heights Water s reported incorporated with a capital 0,000, by W. A. Irwin and C. E. Turner, Monica, and Gus D. Harper, of Los An-

Luis, Colo.—Press reports state that the uis Valley Irrigation, Land & Power Co. out to let contract for a reservoir, to ibout $300,000. The company proposes to gorge 80 ft. high and 250 ft. across at The dam will be 160 ft. and 600 ft. wide; eans of this dam the company will open tion to about 40,000 acres of fertile land n Luis Valley. The company includes S. ernard and E. R. Stark, of Colorado gs, and W. O. Meier, of La Jara. City E. W. Case, of Colorado Springs, is also ed interested.

inison, Colo.—See "Power, Plants, Gas and icity."

istol, Conn.—Chas. L. Wooding, Gen. Bristol Water Co., writes that the con- for laying 2 miles of water main and for ng a new dam (bids opened Apr. 1) has awarded Condon & Pierson, of Bristol. act price reported to be about $30,000.

eriden, Conn.—The Builders Iron Fdry., dence, R. I., has secured the contract from ity for a 5,000,000 gal. high duty d'Auria ing engine to be erected at Kenmere Pump- tation.

st Hartford, Conn.—Jos. O. Goodwin, Clk., writes that no estimate has yet made for the improvements contemplated ie reservoir in East Hartford. Address E. King, Chmn. Com., East Hartford Dist.

lmington, Del.—The Bd. of Water Comrs. ited to have on Apr. 3 voted to locate the reservoirs and filter plant for the city on Weldon farm tract and Theo. A. Leisen, Engr. Water Dept., was instructed to pre- plans and specifications; total cost of con- tion of the Weldon farm project according ie estimate of Saml. Gray, of Providence, is $979,500, and with engineering and ngencies, $1,126,425.

cadia, Fla.—The citizens are reported to voted Apr. 6 to issue $13,000 bonds for r works, $12,000 for a brick school and o for paving.

wson, Ga.—R. E. Bell, City Clk., writes in rd to the construction of water works, that matter will be determined later on by City icil.

icago, Ill.—Geo. F. Samuel, Asst. Engr. Bu- of Eng., writes that bids will be received Apr. 26 for a 3,000,000 gal. pumping engine two 80-h.p. boilers for the Washington ghts pumping station.

ty Engr. Ericson is stated to have com- ced surveying for the new water tunnel from higan Ave. to the Harrison St. pumping on; it will cost about $190,000.

ical press reports state that preparations being made to demolish the Lake View and begin the construction of the new r station at the cost of $68,500. The new will be similar to the Carter H. Harrison

oalgate, Ind. Ter.—Burns & McDonnell, 509 ght Bldg., Kansas City. Mo., are preparing is for water works for Coalgate.

Alexandria, La.—The City Clk. writes that contract for developing an additional supply 500,000 gal. of water daily from artesian s (bids opened Apr. 4) has been awarded P. J. Patorno & Co., of New Orleans, for ,000.

ew Roads, La.—Water bonds to the amount $14,000 are reported sold. and it is stated work on the water system will begin im- iliately.

Iomer, La.—See "Power Plants, Gas and ctricity."

Vaterville, Me.—Bids will be received by onard Metcalf, Engr., 14 Beacon St., Boston, ss., Apr. 29, for laying c. i. water pipe and urtenances in Waterville, Winslow. Fairfield Benton for the Kennebec Water District, as ertised in The Engineering Record.

Iyde Park, Mass.—At the recent town meet- a committee was appointed to report within days on the purchasing of the plant of the ter company.

Lawrence, Mass.—The Com. on Water Works is stated to have voted Apr. 11 to recommend the construction of an additional filter bed at an estimated cost of $60,000.

Boston, Mass.—The Bd. of Aldermen is reported to have received a message from the Mayor recommending the passage of a loan order of $330,000, to be expended by the Water Comrs. in the extension and renewal of water mains.

North Andover, Mass.—Press reports state that at a special town meeting Apr. 8 the Water Comn. was instructed to petition Legislature for authority to issue $50,000 bonds for water main extensions. The issue of $27,850 bonds for water works extensions and installing a new pumping engine and the purchase of a site for primary school were authorized at this meeting.

Hadley, Mass.—Bids will be received until Apr. 26 at the office of E. C. & E. E. Davis, Engrs., Northampton, for furnishing 800 tons of 4, 6 and 8-in. c. i. pipe, special castings, valves, hydrants, etc.; hydrants, valves, etc.; and for building a small dam and laying about 9 miles of water pipe all for the proposed system of water works at Hadley; all three proposals advertised in The Engineering Record.

Manistique, Mich.—John I. Jennings, City Clk., writes that it was voted Apr. 3 to issue bonds for water works and a sewerage system, probable cost, $82,000. Engineer, Geo. W. Sturtevant, Chicago, Ill.

Grand Rapids, Mich.—At the election Apr. 3 the citizens voted against issuing bonds for an up-river water system and filtration plant.

Belding, Mich.—Geo. Moulton, City Clk., writes that the citizens have voted to issue $65,000 bonds for the construction of water works. No engineer selected as yet.

St. Clair, Mich.—H. W. Braun, City Clk., writes that the citizens voted Apr. 3 to issue $10,000 bonds for improvements to the water works. No engineer selected as yet.

Torah, Minn.—See "Power Plants, Gas and Electricity."

St. Paul, Minn.—The Bd. of Water Comrs. is reported to have been authorized to issue $500,000 bonds for extensions of the city water works by a bill approved on Apr. 5 by the Ramsey County House delegation.

White Bear Lake, Minn.—Oscar Claussen, Consulting Engr., National German-American Bank Bldg., St. Paul, writes that bids will be received on Apr. 24 for constructing water works for the village of White Bear, to consist of a pipe line and steel tower and steel tank. Plans will be ready about Apr. 15.

Eyota, Minn.—W. J. Moulsten, Village Recorder writes that there is some talk of constructing water works here, but nothing definite has yet been done.

Fairmont, Minn.—See "Power Plant, Gas and Electricity."

**Lumberton, Miss.*—Engr. R. C. Huston, of Laurel, writes that the contract for sinking 2 artesian wells, one at Lumberton, the other at Poplarville, has been awarded to A. B. Blakemore, of New Orleans, La., for about $7,000.

Cassville, Mo.—It is reported bids are wanted, Apr. 28, for furnishing material and constructing a system of water works. W. D. Steele, City Clk. Burns & McDonnell, Engrs., 509 Dwight Bldg., Kansas City. E. C. Frost, Mayor.

St. Louis, Mo.—Bids will be received until Apr. 25 by the Bd. Pub. Improv. (Waller Edwards, Secy.), for furnishing and delivering at the City Pipe Yard, about 3,900 tons c. i. coated water pipe, 150 tons c. i. coated special castings, 95 6-in., 20 12-in., 5 20-in. and 2 36-in. stop valves, and about 190 fire plugs; also for excavating, hauling and laying complete about 56,800 lin. ft. 6-in., 21,800 lin. ft. 12-in. and 3,800 lin. ft. 20-in. water pipes, setting 190 fire plugs, and furnishing 5,500 lbs. wrought-iron straps, bands, etc.

Bids will be received. on May 2, by the Bd. Pub. Improv. (Waller Edwards, Secy.) for furnishing material and laying a 7-ft. flow line from Baden to the Chain of Rocks. Approximate quantities: 1,500 cu. yds. excav., Class A,; 2,400 cu. yds. excav., Class B; 210 cu. yds. wrecking, 1,500 sq. ft. stone paving and rip rap; 350 cu. yds. concrete, Class A; 820 cu. yds., Class B; 1,670 cu. yds., Class C; 400 cu. ft. granite; 24,000 lin. ft. reinforcing bars; 75,100 lbs. iron work; two 7x6-ft. and four 3x3-ft. rectangular gates, and two 11x9-ft. double rectangular gates; two 7-ft. circular gates and one 2-ft. circular gate; one 36-in. low pressure flanged gate valve; 19,634 lin. ft. 7-ft. steel pipe in place and a bridge superstructure, 137-ft. span. Appropriation, $600,000.

Glasgow, Mont.—It is stated that plans are being prepared for water works and a sewerage system. A Mahon, City Engr.

Suncook, N. H.—R. M. Weeks writes that the cost of extending the water system to Hooksett Village is $10,000. No engineer engaged as yet.

Montclair, N. J.—The Great Notch Water Co. of Montclair, which is reported to have made an offer to supply Bloomfield with water, has filed articles of incorporation, with a capital of $150,000. Incorporators: Fred A. Brainerd and Robt. T. Fowler, of Mt. Vernon, N. Y.; Jasper R. Rand, of Montclair, and others. The company proposes to lay mains from its plant to connect with the Bloomfield system.

Camden, N. J.—The Camden County Water Co., of Camden, is reported incorporated to construct water works; capital, $150,000. Incorporators: T. H. Connell, Chas. H. Barritt, Abel Bottoms, and others, all of Camden.

Jersey City, N. J.—The Finance Bd. is reported to have authorized the Ch. Engr. of the Street and Water Bd. to prepare plans and specifications for laying of a 16-in. water main from Communipaw Ave. through Old Caven Point Road and under upper New York Bay to Bedloe's Island.

New York, N. Y.—Bids will be received, Apr. 24, by Edw. M. Grout, Compt., for $25,000,000 bonds, portions to be used as follows: $2,500,000 for a water supply, $16,000,000 for various municipal purposes, $2,500,000 for the construction of the Rapid Transit R. R., $1,000,000 for the construction of a building in Bryant Park, etc.

Salamanca, N. Y.—See "Power Plants, Gas and Electricity."

Utica, N. Y.—The Utica Consolidated Water Co. (Wm. S. Bascot, Engr. & Gen. Mgr.) is stated to have completed specifications for the excavation and laying of 17 miles of c. i. water pipe.

Cohoes, N. Y.—Press reports state that bids will be received by the Water Board on Apr. 24 for one displacement pump of 3,500,000 gal. capacity and one centrifugal pump of same capacity; bids will also be received same time for motors to operate pumps.

Ft. Ontario, N. Y.—Bids will be received by Capt. W. M. Coulling, Q. M., U. S. A., May 11, for furnishing material and constructing a water distribution system also constructing a side track, as advertised in The Engineering Record.

West Point, N. Y.—Bids will be received by the Quartermaster, U. S. M. A., at West Point, on May 11, for laying about 32,000 ft. of 20-in. c. i. water pipe, as advertised in The Engineering Record.

Niagara Falls, N. Y.—City Engr. is stated to have prepared a report on the water question and recommends three plans: one to build a new pumping station and filtration plant on the upper river; another to condemn plant of Niagara Falls Water Wks. Co., and build a filtration plant in connection with it, and the third to make a long term contract with the Niagara Water Wks. Co. The Bd. of Pub. Wks. is reported to have instructed City Engr. Read to ascertain cost and details of the 3 propositions, so that the taxpayers, by vote, may indicate which proposition they desire.

The Bd. of Pub. Wks. is reported to have authorized the City Clk. to secure bids for furnishing the city with a pure and wholesome water supply.

Scotia, N. Y.—Jas. A. Hoyt, Jr., Village Clk., writes that bids will be received on May 1 for the construction of water works. Engr., L. B. Sebring, Schenectady.

Lexington, N. C.—Bids will be received by the Mayor and Bd. of Town Comrs., on May 3 for the construction of water works, as advertised in The Engineering Record.

Lorain, O.—The City Council is stated to have on Apr. 3 passed an ordinance to issue $50,000 bonds for the improvement of water works; also an ordinance that preliminary steps be taken for an additional issue of $50,000 by a vote of the people.

Toledo, O.—A committee of five was appointed by President Willard of City Council, Apr. 10, to consider the water works filtration matter.

**Canton, O.*—The contract for constructing the pumping station (bids opened Apr. 3) has been awarded to G. A. Whike, of Canton, for $24,888, not including stack.

Lockland, O.—See "Power Plants, Gas and Electricity."

Ft. Reno, Okla. Ter.—Bids, including plans and specifications, will be received May 6 by Robt. R. Stevens, Ch. Q. M., Dept. of Texas, San Antonio, Tex., for furnishing and erecting a 60,000 gal. wooden tank and trestle at Ft. Reno.

Esplen, Pa.—The Excelsior Water Co. and the Panhandle Water Co. are stated to have petitioned the Borough Council for franchises.

Ashland, Pa.—The City Council is reported to have appropriated $5,000 for improving the west end water system.

Ford City, Pa.—Bids will be received until May 1 by the Council for constructing an engine house, a pump pit, and filtering well; also laying approximately 2,000 ft. c. i. water pipe. The McNulty Eng. Co., 503 5th Ave., Pittsburg, are the engineers.

Pawtucket, R. I.—Percy H. Blake has presented to City Council his report on the investigation of the general condition of the water works; he recommends improvements the total cost of which are $300,000, and include the erection of new buildings for at least 2 pumping engines, each of 15,000,000 gal. capacity, and 4 boilers; one of the engines and the 4 boilers to be installed at once; the construction of a coal storage house and spur track, and the laying of a new force main and distributing connections.

Edgefield, S. C.—See "Power Plants, Gas and Electricity."

Bamberg, S. C.—See "Power Plants, Gas and Electricity."

Franklin, Tenn.—The State Senate has passed a bill authorizing this city to issue water works bonds.

Henning, Tenn.—The State Senate has passed the bill authorizing this city to issue water works bonds.

Nashville, Tenn.—There is a bill pending in Council for $11,000 to be used for 2 boilers for the pumping station.

Austin, Tex.—The citizens are reported to have voted Apr. 3 to authorize the City Council to make a contract for rebuilding the dam. and the State Legislature will now be called upon to amend City Charter to empower Council to make such a contract.

Beaumont, Tex.—The City Council is stated to have passed a resolution providing for municipal ownership of the water works, either by the purchase of present works or construction of new system.

Salem, Va.—Bids are wanted May 1 for an all-steel water tower with a tank having a capacity of 150,000 gals. and the height to be 100 ft. from the piers to the bottom of hemisphere, or 148 ft. 3 in. from piers to the top of cylinder. Requests for information must be accompanied by a check for $6.50, payable to J. N. Ambler, Designing Engr., to cover the cost of drawings and specifications, and must state length of time applicant has been engaged in such work. W. B. Dillard, Chmn. Water Com.

Ft. Wright, Wash.—Bids will be received May 1, by Capt. Edw. A. Shuttleworth, Q. M., U. S. A., for constructing reinforced concrete reservoir of 200,000 gals. capacity, pumping station, installing motor-driven, triplex pump and laying and connecting water mains at Ft. Wright.

Spokane, Wash.—City Engr. A. F. Gill is stated to have submitted to City Council plans for a new water service. The plans recommend the installation of a high and low reservoir service, pipe lines and power house, at a total cost of about $420,000.

Tacoma, Wash.—The lowest bid opened on Mar. 31 for installing two vertical triplex pumps at the wells at South Tacoma is stated to have been submitted by the Tracy Eng. Co. It submitted 4 bids, ranging from $9,547 to $10,760.

De Pere, Wis.—Bids will be received until May 4 by M. J. Maes, City Clk., for improving the water works plant, the work to be let in parts as follows: 13,870 ft. 6, 8, 10 and 12-in c. i. pipe, and 22,000 lbs. special castings; 34 fire hydrants and 29, 6, 8, 10 and 12-in. gate valves; 50,000 gal. elevated steel tank and tower; a 500-gal. triplex power pump; a 50-hp. suction gas producer and gas engine; two 50,000 gal. concrete reservoirs; 20 or more meters, ⅝ to 1-in.; the laying of the pipe, setting of the hydrants, etc. For further information apply to W. G. Kirchoffer, Engr., Madison, Wis.

La Crosse, Wis.—Jos. M. Sieger, City Clk., writes that the question of issuing bonds for the construction of a filtration plant, was defeated at the election, Apr. 4.

**Spooner, Wis.*—W. D. Lovell, of Minneapolis, Minn., has secured the contract for constructing water works for $13,000 (bids opened Mar. 20). Engineer, Oscar Claussen, St. Paul, Minn.

Sheboygan, Wis.—The citizens voted Apr. 4 to purchase the plant of the City Water Co. at a cost of $350,000, to take possession on Jan. 1, 1908.

Monroe, Wis.—The citizens are reported to have voted Apr. 4 to purchase the water works, at a cost of $101,500.

Hartford, Wis.—The citizens are reported to have voted to issue bonds for extending the water mains.

Cody, Wyo.—G. W. Zorn, Ch. Engr., Big Horn Basin Development Co., writes that all bids opened on Apr. 3 for the construction of the first 16 miles of the Shoshone River Canal have been rejected, as the bids received were not satisfactory and new bids will be received May 1 as advertised in The Engineering Record.

Brandon, Man.—Bids will be received by Geo. R. Coldwell, Chmn. Water Works Com., on May 1, for laying 21,300 lin. ft. 12, 10, 8 and 6 in. pipe, including hydrants, valves and specials, as advertised in The Engineering Record. Material to be furnished by city.

Toronto, Ont.—City Engr. Rust is reported to have estimated that it will cost $12,000 to lay a 12-in. water main on the Ashbridge Marsh.

SEWERAGE AND SEWAGE DISPOSAL.

Birmingham, Ala.—Julian Kendrick, City Engr., is reported to be preparing plans for two purification plants for the county, one to be erected on Valley Creek, about 2½ miles from Bessemer, the other on Village Creek, one mile south of Ensley.

**Ocean Park, Cal.*—Arthur S. Bent, of Los Angeles, is stated to have, on Mar. 28, secured the contract for constructing a sewerage system for $11,889. The Olmstead-Poulson Co. secured the contract for the septic tank at $8,196.

Waterbury, Conn.—The City Engineer and his assistants are reported to be securing land for a sewage disposal plant to be erected in the southern end of the city.

Waterbury, Conn.—It is stated that bids will be received, until May 2, for constructing several sewers. R. A. Cairns, City Engr.

Jacksonville, Fla.—Local press reports state that bids will be received by the Bd. of Bond Trus. until May 4 for furnishing material and laying a 24-in. brick drain in Bridge and Adams Sts., a total distance of 635 ft., estimated cost $2,640, and a 30-in. drain on Margaret St., 600 ft., to be of terra cotta, and 1,720 ft. of brick; estimated cost, $8,580.

Quitman, Ga.—It is reported bids will be received by Mayor E. L. Julks, for $50,000 sewerage and paving bonds.

Augusta, Ga.—Bids will be received by the Health Com., Apr. 20, for furnishing material and constructing approximately 1,634 lin. ft. of 63 to 66-in. brick sewer in a portion of Turknett Springs Road. Nisbet Wingfield, Comr. Pub. Wks.

Springfield, Ill.—City Engr. E. W. Case is reported to be preparing plans for a main outlet sewer line on S. Nevada Ave.

Chicago, Ill.—Bids will be received Apr. 18 by the Bd. Local Improv. (And. M. Lynch, Pres.) for constructing house drains in portions of 14 streets, and vitrified tile pipe sewers with manholes and catch basins in portions of 14 other streets.

Bloomington, Ill.—It is proposed to lay pipe sewers on Clinton and Bell Sts. Elmer Folsom, City Engr.

Quincy, Ill.—Estimates are being made for 1,600 ft. of 10-in. pipe sewer, and 4,400 sq. yds. of rock asphalt pavement, with combined curb and gutter of cement, in Lanandale. Addition to City of Quincy. F. L. Hancock, City Engr.

**Logansport, Ind.*—W. A. Osmer, City Engr., writes that the following are the bids opened on Apr. 5 for constructing a sewerage system on the West Side: Dennis Uhl, Logansport. $136.615 (awarded contract); J. H. Green Sons Appleton, Wis., $138,482; McNichols & Cogan, Chicago, Ill., $163,337; James McClerncock, Frankfort, $147,274; Cain Constr. Co., Dayton, O., $141,221; Fred Hoffman, Rochester, Ind., $149,536; M. L. Bowlen, Tipton, $146.861, and Jerry Kerns, Logansport, $149,118. These bids

**Items marked thus give the names of parties awarded contracts.*

do not include manholes, catch basins or rock excavation, which were bid on at a unit figure, according to quantity.

Mooresville, Ind.—It is stated that a sewerage system will be constructed here, to be about 3½ miles in length.

Lafayette, Ind.—It is stated that bids are wanted, Apr. 24, for constructing Section 3 of brick sewer in Cincinnati St. E. H. Andress, Jr., City Clk.

Terre Haute, Ind.—John White, Secy. Bd. Pub. Wks., writes that the city has in contemplation the building of a sewer in N. 21st St., 5 squares in length.

**Indianapolis, Ind.*—The Julius Keller Constr. Co., 127 Fulton St., is reported to have secured the contract for building the Senate Ave. sewer from Fall Creek to 38th St., at $3.21 per lin. ft.; total cost about $100,000.

Ft. Wayne, Ind.—Bids will be received until May 6 by the Bd. Co. Comrs. (Chas. G. Griebel, Chmn.), for furnishing and delivering at the jail yard, as ordered by the Comrs., c. i. culvert pipe for the ensuing year beginning May 6. The size of the pipe to be as follows: 18-in. inner diameter, 11-16-in. shell, 24 and 30-in. inner diameter ¾-in. shell, 36-in. inner diameter, ⅞-in. shell, 42-in. inner diameter 1-in. shell, 48-in. inner diameter, 1⅛-in. shell. The weight of the bell socket to equal two-thirds of the weight of 1 ft. plain pipe. A variation of 2½ per cent. of weight per foot will be allowed.

Davenport, Ia.—Bids will be received by the Bd. Pub. Wks., Apr. 18, for constructing sewers in portions of 8 streets, requiring about 7,864 lin. ft. of 12-in. and 400 lin. ft. of 10-in. pipe. Thos. Murray, City Engr.

**Eureka, Kan.*—The City Council is reported to have awarded the contract for putting in sewerage district No. 1 to Matt & Huntington, of Kansas City. Section 1 includes the business portion of the town.

Coffeyville, Kan.—Bids will be received until Apr. 20 by the Mayor for constructing a storm sewer system in this city. E. H. Ricksecker, City Engr.

Hopkinsville, Ky.—H. M. Dalton is about to petition Council for a franchise for a sewerage system.

Northampton, Mass.—Egbert I. Clapp, City Clk., writes in regard to the main sewer, that its destination has not yet been decided upon. If it will run to Connecticut River it will cost $100,000 and if to Mill River $20,000. M. D. Patteson, City Engr.

Lowell, Mass.—The Com. on Sewers is reported to have under consideration the construction of the Oakland sewer.

The Com. on Sewers on Apr. 5 voted to recommend a loan of $50,000 for the work of the Sewer Dept. during the present year.

Manistique, Mich.—See "Water."

Woodmere, Mich.—The Council is stated to have adopted a resolution authorizing the Village Attorney to draw up a petition to the State Legislature asking permission to bond the village for $150,000, with which to construct a sewerage system.

Pipestone, Minn.—S. W. Funk, City Recorder, writes that it was voted Apr. 4 to construct a sewerage system. No engineer selected as yet.

Fairmont, Minn.—See "Power Plants, Gas and Electricity."

St. Paul, Minn.—Bids will be received, Apr. 17, by the Bd. Pub. Wks. (R. L. Gorman, Clk.), for constructing sewers in portions of Delos St. and Clinton Ave.

St. Joseph, Mo.—All bids opened on Apr. 5 by the Bd. of Pub. Wks (Geo. F. Barnes, Clk.), for the Wyatt Park sewer, were rejected as being too high; this sewer will require 3,000 lin. ft. of concrete or brick sewer, together with necessary inlets and manholes; probable cost, $10,000.

Glasgow, Mont.—See "Water."

South Omaha, Neb.—Press reports state that Andrew Rosewater, of Omaha, estimates the cost of sewers for South Omaha as follows: A sewer from Swift's plant, $145,000; second main sewer to be laid under tracks north of L St., $85,000, and the sewer to drain the 3d Ward and Corrigan addition, $25,000. He suggests that either brick or concrete be used in the construction. When City Council finally accepts plans a special election will be held to vote on issuing $250,000 bonds.

**Atlantic City, N J.*—The following are reported to be the bids opened on Mar. 28 by City Council for the Atlantic Ave. drainage system: Russell Constr. Co., $17,128 (awarded contract); Daniel S. Bader, $20,282, and the McGovern Constr. Co., $21,285.

Jersey City, N. J.—Bids will be received until Apr. 17 by the Street & Water Comrs., (Geo. T. Bouton, Clk.) for constructing a sewer in a portion of Hudson Boule. and Cator Ave. Estimated quantities: 1,310 lin. ft. 36-in., 1,320 lin. ft. 30-in. oval brick sewer, 220 lin. ft. 15-in., 340 cu. yds. rock excav., etc.

New York, N. Y.—Bids will be received Apr. 19 (readvertisement) by John F. Ahearn, Boro Pres., for constructing a sewer in a portion of Bway. Engineer's estimate: 150 lin. ft. of brick sewer, 3 ft. 6 in. x 2 ft. 4 in. interior diam. in tunnel; 14 lin. ft. of brick sewer, 3 ft. 6 in. x 2 ft. 4 in. interior diam. in vault; 7 cu. yds. brick masonry, laid in cement mortar.

Bids will be received Apr. 12 by Louis F. Haffen, Pres. Boro. Bronx, for constructing sewers and appurtenances on 6 streets. Engineers' estimate: 255 ft. of 18-in., 415 ft. of 15-in., and 1,685 ft. of 12-in. sewer pipe; 35 ft. of 12-in. and 235 ft. of 6-in. c. i. pipe; 175 cu. yds. rock to be excav. and removed; 1,040 cu. yds. rubble masonry in mortar; 350 cu. yds. concrete, reinforced with steel bars, 30 manholes, complete, etc.

Brooklyn, N. Y.—Bids will be received Apr. 26 by Martin W. Littleton, Boro. Pres., for furnishing material and constructing sewers in portions of Grafton St. and Lincoln Road. Engineer's estimate: 2,000 lin. ft. 12-in., 340 lin. ft. 15-in. and 276 lin. ft. 18-in. pipe sewer, 26 manholes, etc.

Amsterdam, N. Y.—It is stated that bids will be received, until Apr. 19, for constructing an 18-in. storm drain, about 700 ft. long, with 7 catch basins. F. E. Crane, City Engr.

Sherburne, N. Y.—Levi Collins, Village Clk., writes that it is not proposed at this time to construct a sewerage system.

**Troy, N. Y.*—P. A. Lillis is stated to have secured the contract for constructing a sewer in Spring and Pawling Aves., for $14,757.

Ithaca, N. Y.—The Bd. of Sewer Comrs. has appointed Professors Ogden and Crandall, a special committee, with power to employ engineers, to make a thorough investigation and suggest a remedy for abating the nuisance in Cascadilla Creek, resulting from the overflow from the sewer station.

Lestershire, N. Y.—Knight & Hopkins, of Rome, are reported to be completing plans for the proposed sewerage system. J. E. Hill, City Clk.

Ft. Caswell, N. C.—Bids will be received Apr. 26 by R. H. Williams, Q. M., U. S. A., for making certain changes in sewer here.

Cincinnati, O.—Bids will be received May 3 by the Bd. of Pub. Service (Geo. F. Holmes, Clk.) for furnishing material and improving portions of five streets by constructing drains and sewers.

Bids will be received by W. T. Perkins, City Aud., until May 8 for $350,000 sewer construction bonds.

Toronto, O.—Bids will be received on May 1 by the West End Sewer Co., at its office on Clark St. (Engr. A. G. White) for the construction of a sewerage system to include 27,120 lin. ft. 8 to 30-in. sewer pipe, 120 lin. ft. 30-in. c. i. pipe, 39 manholes, 14 drop manholes and 35 lampholes.

**Columbus, O.*—The contract for the central relief sewer is stated to have been awarded to C. T. McCracken, of Cleveland, for $117,744, brick construction. (Bids opened Mar. 29.)

Urbana, O.—Young, Fardwell & Hooke, of St. Louis, Mo., have been selected to prepare plans for a sewerage system for Urbana.

Alliance, O.—J. K. Auld, of Canton, is reported to have secured the contract for constructing a storm sewer 3,200 ft. in length on Summit St. (bids opened Apr. 6), for $4,922.

Findlay, O.—It is stated that bids are wanted by the Bd. Pub. Service (J. C. Edie, Clk.), for constructing a sewer in Washington St.

Norristown, Pa.—An ordinance has been introduced in Council providing for the construction of 29 miles of sanitary sewers.

Media, Pa.—The Boro. Council on Apr. 5 is stated to have appointed a committee consisting of Winfield S. Worrall, H. L. Broomall, Dr. E. M. Harvey and President S. A. Feld, to look into the matter of constructing a sewerage system, and report back to Council.

Sharon Hill, Pa.—The Borough Council is stated to have adopted an ordinance providing for the construction of a sewerage system. Jas. Farrell, Chmn. Sewer Com.

Harrisburg, Pa.—Local press reports state that bids are to be received by the Highway Dept., until Apr. 17, for constructing sewers. M. B. Cowden, City Engr.

Saltsburg, Pa.—It is stated that bids are wanted, May 4, for 170 ft. of 10-in. sewer, including manholes, inlets, etc. Hiram Smith, Boro Clk.

Ft. McIntosh, Tex.—The following are reported to be the bids opened on Mar. 29 by Robt. R. Stevens, Q. M., U. S. A., San Antonio, for construction of sewers: (*a*) for construction of sewers complete (b) construction of sewers less 200 ft.: Jos. Netzer, *a* $20,699; *b* $11,749; A. Deutz & Bro., *b* $16,927.

**Seattle, Wash.*—The contract for constructing a main sewer in Ranier Ave., (bids opened Mar. 25) has been awarded to F. McLellan & Co., 435 Burke Blk. on Plan No. 3 for brick sewers for $82,606. For detailed bids received for this work, see issue of The Engineering Record, Apr. 8

**Sheboygan, Wis.*—The following are the bids opened on Apr. 6 for constructing sewers: O'Shea & Shea, Hammond, Ind., $16,791; A. C. Schreiter & Co., Appleton, $14,967; Hackworthy Const. Co., Appleton, $11,730 (awarded contract); R. Nommensen, Sheboygan, $12,276; Wm. Schaetzer, Sheboygan, $12,887, and Young & Gray, Manitowoc, Wis., $11,952. The detail bid of the successful bidder, the Hackworthy Constr. Co., is as follows: 400 ft. 20-in. pipe, $2.50 per ft.; 1140 ft. 18-in., $2.15; 800 ft. 15-in., $1.70; 1,720 ft. 12-in., $1.36; 2,470 ft. 10-in., $1.25; and 33 manholes, ea., $45.25.

**Milwaukee, Wis.*—Wm. T. Duke has secured the contract for building the outlet and engine foundation for the Kinnickinnic flushing tunnel, for $14,319.

BRIDGES.

Notes Arranged Alphabetically by States.

Birmingham, Ala.—Bids will be received by Julian Kendrick, City Engr., Apr. 19, for reflooring the 21st St. viaduct.

Birmingham, Ala.—H. S. Morrow, Clk. Bd. of Revenue of Jefferson County, writes that bids will be received by this Board on May 4 for the construction of 9 iron bridges.

Greenwood, Ark.—Bids will be received, until May 1, at the Court House, Greenwood, for furnishing material and constructing a steel bridge across James Fork, in Sebastian, 1 mile south of Hackett City, main span 80 ft., and 2 approaches 32 ft. each, and for constructing a steel bridge across Vache Grasse Creek, on Lavaca Road, 2 miles north of Greenwood, to consist of an 80-ft. main span and 2 approaches 32 ft. each. Wm. A. Falconer, Co. Judge.

Wilmington, Del.—See "Railroads."

Washington, D. C.—Specifications are on file at the office of The Engineering Record, 114 Liberty St., New York, N. Y., for the construction of a 7-span steel bridge across eastern branch of Potomac River at foot of 11th St. S., bids to be received May 1, as advertised in The Engineering Record.

Chicago, Ill.—The lowest bids opened on Mar. 23 by F. W. Blocki, Comr. Pub. Wks., for a bridge on North Ave., across North Branch of Chicago River, were submitted as follows: Superstructure, Roemheld & Gallery, 719 Chamber of Commerce Bldg., $111,983, and substructure, Jackson & Corbett, 1132 Rookery Bldg., $81,368.

Mt. Carroll, Ill.—The City Clerk writes that the citizens voted Apr. 3 to issue about $7,000 bonds for the construction of a wagon bridge over Carroll Creek. No engineer selected as yet.

Bluffton, Ind.—It is stated that bids will be received, until May 3, by C. S. Brineman, Co. Aud., for constructing 14 concrete steel bridges.

Cedar Rapids, Ia.—The Marsh Bridge Co., of Des Moines, is stated to have received the contract for constructing a concrete bridge over Cedar River at 2d St., for $82,100.

*Bartlett & Kling, of Cedar Rapids, have secured the contract for a reinforced concrete bridge—3 spans—for the Cedar Rapids & Marion Ry. Co., and are in the market for plans for this bridge, as same have not yet been adopted.

Springfield, Mass.—The following are the bids opened on Apr. 8 by the Comrs. of Hampden County for the construction of a bridge over the Connecticut River, bet. Chicopee and West Springfield: King Bridge Co., Cleveland, O., $48,700; Berlin Constr. Co., Berlin, Conn., $59,579; New England Structural Co., Everett, $48,495; Groton Bridge Co., Groton, N. Y., $58,000; Owego Bridge Co., Owego, N. Y., $49,500; Canton Bridge Co., Canton, O., $55,000; New Jersey Bridge Co., New York, N. Y., $44,777; Boston Bridge Wks., Boston, $47,593; Levering & Garriques, New York City, N. Y., $53,000; Massillon Bridge Co., Massillon, O., $52,000; Eastern Steel Co., Boston, $48,390; Converse & Co., $49,900; R. F. Hawkins, Springfield, $43,749; L. F. Shoemaker & Co., $52,494; Springfield Constr. Co., Springfield, $49,970; Pennsylvania Steel Co., Steelton, Pa., $58,000; Belmont Iron Wks., Philadelphia, Pa., $45,900; United Constr. Co., Albany, N. Y., $47,379; Penn Bridge Co., Beaver Falls, Pa., $54,300, and American Structural Steel Co., $44,800.

Newton, Mass.—The Metropolitan Park Comn. of Boston, will probably construct a bridge over Charles River, at Boylston St.

**Manistee, Mich.*—G. B. Pike, City Engr., writes that the contract for removing present draw-bridge and building new one over Manistee River at Maple St. (bids opened Mar. 30) has been awarded to the Scherzer Rolling Lift Bridge Co. The Scherzer design is double leaf deck; 70 ft. clear channel, equipped for electric and hand power operation; approaches, retaining walls and all complete for $36,000.

Elk River, Minn.—Bids will be received Apr. 22 by the Bd. of Superv. (N. K. Whittemore, Chmn.) for $7,500 bonds for constructing a bridge over the Mississippi River at this place.

Carrollton, Mo.—Bids will be received until May 2 by W. J. Leathem, Bridge Comr., for constructing 3 steel bridges.

New York, N. Y.—Bids will be received Apr. 12 by Louis F. Haffen, Pres. Boro. Bronx, for constructing approaches to bridges over the N. Y. C. & H. R. R. R. and the N. Y. & Putnam R. R. at Depot Pl. and W. 177th St. Engineer's estimate: 6,300 cu. yds. excav.; 1,950 cu. yds. dry rubble masonry; 9,400 cu. yds. of concrete; 100 bbls. Portland cement; 3,400 lin. ft. new curb; 16,400 sq. ft. new flag; 3,500 sq. yds. granite block pavt.; 4,000 sq. yds. macadam pavt.; 155,000 lbs. iron and steel; 11,500 lbs. reinforcing bars; 1,850 lin. ft. ornamental railing, etc.

Syracuse, N. Y.—Bids will be received Apr. 19 by N. V. V. Franchot, Supt. State Bd. Pub. Wks., Albany, N. Y., for constructing the superstructure of a lift bridge over the Oswego Canal at Willow St. here.

Columbus, O.—Bids will be received May 4 by the Co. Comrs. for furnishing material and constructing the substructure, superstructure and approaches of the Lockbourne Canal Bridge in Hamilton Township; substructure of the Black Lick Creek Bridge, south of Brice, in Madison Township; substructure of the Schott Bridge in Blendon Township; approaches of the Higgins Bridge on the Hard Road, in Perry Township. Specifications may be obtained from the Co. Engr. at $1 for each superstructure and substructure. L. E. Jones, Co. Aud.

Medina, O.—Bids will be received May 1 by the Co. Comrs. for constructing a steel bridge with masonry substructure, over Rocky River, in Liverpool Township, to consist of 1 span, length 120 ft., with a clear roadway of 16 ft. W. H. Hobart, Co. Aud.

Wooster, O.—Press reports state that the Co. Comrs. will receive bids Apr. 20 for $16,000 bonds, to be used to erect and repair bridges.

Dayton, O.—The lowest bid opened on Apr. 4 by the Bd. of Pub. Service for re-erecting old bridge at Summit St. was submitted by J. C. Morrison, of Dayton, for $4,600. The lowest bid for the abutment walls was submitted by Geo. R. Hively, of Dayton, at $4.46 per cu. yd.

**Portland, Ore.*—The contracts for repairing the Burnside St. Bridge are stated to have been awarded as follows: The Diamond Sand Co., retaining walls, $745; Paquet & Giebish, embankment and planking, the redecking of the road and the wood block paving, $7,209; J. B. Tillotson, pile approach and sidewalks on the iron bridge, $3,586.

Pittsburg, Pa.—Bids will be received by the Dept. Pub. Wks. (Edw. M. Bigelow, Dir.) until Apr. 18, for repairing S. 22d St. bridge and reflooring Lawn St. bridge.

Foss, W. Va.—The Greenbrier Toll Bridge Co. is reported incorporated to construct a bridge over Greenbrier River at Foss, at a probable cost of $16,000.

Milwaukee, Wis.—Edwin Henkel, City Clk., writes that the citizens voted Apr. 4 to issue $125,000 bonds for constructing a bridge over Kinnickinnic Ave. For further information address Chas. J. Poetsch, City Engr.

PAVING AND ROADMAKING.

Notes Arranged Alphabetically by St

San Francisco, Cal.—The Bd. of Pu is stated to have opened on Mar. 30 the ing bids for paving with asphalt a por Mission St. Barber Asphalt Paving C Sansome St., $64,816, and City Street I ment Co., Mills Bldg., $67,529.

The City Engr. is stated to have e the cost of grading a portion of Fulto $13,500.

The Bd. of Pub. Wks. is stated to h cided to pave with basalt blocks a por Berry St.

Washington, D. C.—Bids will be rece Apr. 22 by the Comrs. D. C. for gradin sylvania Ave. extended, as advertised Engineering Record.

Arcadia, Fla.—See "Water."

Quitman, Ga.—See "Sewerage and Disposal."

Augusta, Ga.—Bids will be received City Council on Apr. 27 for furnishing and paving 8th St. with either brick o Belgian block, about 10,000 sq. yds., as tised in The Engineering Record.

Bloomington, Ill.—It is proposed to brick pavement on Lee and Oak Sts. Folsom, City Engr.

*The Barber Asphalt Paving Co. has the contract for paving Grove and Wa and Morris Ave. (bids opened Apr. $21,198.

Quincy, Ill.—See "Sewerage and Sewa posal."

Bloomfield, Ind.—It is reported that bi be received May 2 for constructing grav macadamized roads in Stafford, Grant an Townships.

Michigan City, Ind.—The City Cou stated to have decided to pave with brick Ave.

**Ft. Wayne, Ind.*—Contracts have awarded by the Board of Pub. Wks., lows: To the Barber Asphalt Paving Co., a 51,026 sq. yds., at $1.73; grading per c 45 cts. Hatch & Son, Goshen, Ind., vitr. 5,696 sq. yds., at $1.74; grading per c 35 cts. Derheimer & Co., Ft. Wayne, Ind block, 3,346 sq. yds., at $1.74; grading p yd., 30 cts. Moellering Constr. Co., Ft. vitr. block, 2,946 sq. yds., at $1.78; gradi cu. yd., 35 cts. The asphalt to have Portland cement concrete foundation, 1-i der, 1½-in. surface, and the brick 6-in. land cement concrete foundation, 1-in. c 4-in. surface.

Vernon, Ind.—Bids will be received unti 1 by the Co. Comrs. for constructing ab mile of pike road in Center Township. Campbell, Co. Aud.

Indianapolis, Ind.—Bids will be receive til Apr. 24, by the Dept. Pub. Wks. (Downing, Chmn.), for improving portio several streets by grading and paving the walks with cement.

Mt. Vernon, Ind.—It is stated that bid wanted, Apr. 24, by Henry Kling, City Clk constructing macadam pavement and ar stone curb and gutter on 8th St.

Versailles, Ind.—It is stated that bids be received until May 2, by Nicholas Vol Aud., for constructing 2½ miles of ma roads.

Bedford, Ind.—The County Comrs. are to have awarded the contract for constr 6 gravel roads in Pleasant Township to Clark & Co. for $17,050 (bids received Ap

Bids will be received until May 1 by th Comrs. for constructing gravel or macada roads in Marshall Township, in all about 4 ft. Walter G. Owens, Co. Aud.

Attica, Ind.—It is stated that bids wi received Apr. 21 by Saml. Turman, City for improving Washington St.

Bluffton, Ind.—It is stated that bids wanted, Apr. 22, by the Co. Comrs. for structing 15 gravel roads in Jackson Tow

Muncie, Ind.—It is stated that bids wi received Apr. 24 by the Common Counci improving sidewalks on Vine and First R. G. Hickok, City Clk.

Williamsport, Ind.—It is reported bids wanted Apr. 22 for constructing 6½ mile road. J. H. Crawford at Hedrick, Ind., be able to give further information.

Marion, Ind.—L. C. Lillard is stated to received the contract (bids opened Apr. 4) paving with Townsend block on a portio 1st St., at $7.48 per lin. ft.

**Creston, Ia.*—Acting City Engr. M. V. ley writes that W. Horrabin, of Iowa City, secured the contract for paving 3 streets brick at $1.92 per sq. yd. for paving an cts. per lin. ft. for curb. W. J. Joseph is City Engr.

**Shenandoah, Ia.*—Dunnegan, Schwartz Corey are stated to have received the con for paving with Purington blocks about 1 yds. at $1.37, for furnishing 3,500 ft. ce curb at 35 cts., and 4,000 ft. oak curb at 1

Davenport, Ia.—Bids will be received Ap by the Bd. Pub. Wks. for paving portions streets, requiring about 16,076 sq. yds. of fied brick on a 5-in. Portland cement conc foundation. Thos. Murray, City Engr.

Paduch, Ky.—Local press reports state bids will be received by the Bd. Pub. Wks Apr. 26 for paving with bitulithic, asphalt adam or other material on about 15 blocks 3d St.

New Orleans, La.—The following bids stated to have been opened on Apr. 3 by Finance Com., for paving with asphalt port of *a* Dryades St., *b* Barome St., *c* Prytania and *d* Poydras St. (price given per sq. y Empire Asphalt Paving Co., *a* and *b*, $2.86 *c* $2.87⅔; McGovern Constr. Co., *a* $2.15 *c*, $2.02 1-6; Louisiana Improv. Co., He Bldg., *a* $2.25, *b* $2.17 1-6, *c* $2.12; Sici

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**Items marked thus give the names of parties awarded contracts.*

Paving Co., 312 Gravier St., *a* and *b*, $2.51⅔; E. A. Egan, *d*, with sq. block, aven & Co., *d*, with sq. block, $1.39½, H. Douglas, *d*, with sq. block, 90 cts.

re, Md.—An ordinance providing for priation of $38,500 for the paving with iate, kreo-done wood block, or vitrified Center Market Dist., has passed the anch of City Council.

n, Mass.—The Bd. of Pub. Wks. is have awarded the contract for pav- lleys in Dist. No. 3 to Givens, Hughes r, at $19,700.

Mass.—Bids will be received Apr. 17 Metropolitan Park Comn., 14 Beacon ton, for grading, surfacing, etc., at hore Reservation, Lynn, and Swamp- The estimate of the work is approxi- s follows: 3,640 cu. yds. earth grading; yds. concrete gutters; 13,800 sq. yds. tone surfacing; 3,600 sq. yds. walk sur- 5,200 sq. yds. granolithic walk, etc. A of $2 is required for pamphlet contain- ier information. John R. Rablin, Engr. reported bids are wanted, Apr. 18, for g about 100,000 sidewalk paving bricks. R. Parker, Clk.

River, Mass.—The contract for furnish- oo ft. of granite edge stone and 220,000 paving blocks is stated to have been as follows (price given per M.): For locks, Napoleon Ross, 25,000 at $66.75; Cote, 60,000 at $67.50; Wm. Beattie, at $69. Curbing, Napoleon Ross, 4,000 2 cts. per ft.; Beattie & Wilcox, 13,000 a 75 cts.

n, Mass.—See "Miscellaneous."

ng, Mich.—The City Council has under ation the paving of Washington Ave. rand Trunk R. R. to bridge over Grand a distance of 1,813 ft.; cost, $16,900; paving of Ottawa St., a distance of ½ H. A. Collar, City Engr.

aul, Minn.—Bids will be received Apr. the Bd. Co. Comrs. for constructing a id gravel road on a portion of St. Paul, Bear and Bald Eagle Road. Edw. G. r, Co. Aud.

harles, Mo.—Bids will be received until for 4,640 cu. yds. grading, 9,331 sq. yds. brick paving and 4,050 lin. ft. Bedford ie curbing as advertised in The Engi- Record.

ouis, Mo.—Bids will be received until by the Bd. Pub. Improv. (Waller Ed- Secy.), for paving with asphalt, brick, or macadam on portions of several streets.

na, Mont.—Louis Johnson has secured tract for paving Main St. (bids opened) for $45,243, the work to consist of o sq. yds. brick pavt., 1,987 cu. yds. ex- 987 cu. yds. concrete, 789 cu. yds. sand ck pavt., 14,200 sq. yds. old block re- 700 lin. ft. headers, 2,390 lin. ft. curb 1,290 lin. ft. old walk removed and re- ,200 sq. yds. joints of brick pavt. filled out or coal pitch filler, and rolling 14,200 road bed.

ton, N. J.—Bids will be received by the Chosen Freeholders of Mercer County for furnishing material and macadamiz- tain public roads in Mercer County, as sed in The Engineering Record.

ntic City, N. J.—The contract for curb- lantic Ave. is stated to have been warded ard Moss, of Atlantic City, for $43,000. mer & Parker are stated to have re- the contract for reparing the sidewalks or $7,127 (bids opened Mar. 28). will be received, May 9, by the Bd. Freeholders, at Atlantic City (E. S. Chmn.), for filling and graveling a por- f Albany Ave. over the Chelsea Heights J. J. Albertson, Co. Engr.

y City, N. J.—Bids will be received un- . 17 by the Bd. Street & Water Comrs. T. Bouton, Clk.), for repairing macadam ys in Jersey City. Estimate of quantities: ns of stone to pass through a 1-in. ring, ng screenings, 1,200 tons of stone to pass a 1½-in. ring, use of 10-ton roller about ys (including sprinkling), of 10 hours ay:

Brunswick, N. J.—Bids are wanted May 1 ading, curbing and paving with brick a of Hundy St., estimated cost, $10,000. C. Schneider, City Engr.

rson, N. J.—An ordinance has been passed e Bd. of Aldermen providing for the of Bank, Clark, De Grasse, Grand, Ham- Marshall, River, Ryerson and Union Sts. Bway; Hamburg and Park Aves. with as- 32,144 sq. yds., and portions of Grand nd Hamburg Ave. with block, 4,200 sq nd Bway. from E. 33d St. to Passaic River bituminous pavement. H. J. Harder, City g

v York, N. Y.—Bids will be received Apr. Louis F. Haffen, Pres. Boro. Bronx, for ting, grading, setting curbstones, flagging, alks and laying cross walks, etc., on 9 s. Engineer's estimate: 72,350 cu. yds. excav.; 23,300 cu. yds. rock excav.; 96,625 ds. filling; 29,880 lin. ft. new curb., fur- l and set; 113,675 sq. ft. new flag, fur- l and laid; 17,625 new bridgestone for walks, furnished and laid; 2,580 cu. yds. ubble masonry, in retaining walls, cul- and gutters; 650 lin. ft. 12-in. and 2,550 t. 18-in. vit. stoneware pipe; 14,000 lbs. rods in place, etc.

oklyn, N. Y.—Bids will be received Apr. y Martin W. Littleton, Boro. Pres., for shing material and regulating grading, curb- paving and repaving portions of 20 streets; eers' estimate; 75,210 cu. yds. asphalt pavt.; o lin. ft. new curb; 19,336 cu. yds. con- ; 4,440 sq. yds. asphalt block; 33,470 sq. ment sidewalks; 7,447 lin. ft. of new curb, set in concrete; 1,660 sq. yds. brick gut- to be set in concrete; 22,590 sq. yds. granite pavt., with tar and gravel joints; 4,180 ds. wood block pavt.; 4.120 cu. yds. granite,

New Brighton, S. I., N. Y.—The following are bids opened on Mar. 28 by Geo. Cromwell, Pres. Richmond Boro. for furnishing material and paving with granite blocks on sand Richmond Terrace from Johns St. to Central Ave.: (*a*) John E. Donovan, Port Richmond; (*b*) M. Fitzgerald, 312 W. 141st St., N. Y. City; (*c*) Jos. Johnson's Sons, West New Brighton; (*d*) E. A. Matthews, 13 Park Row, N. Y. City:

	a	*b*	*c*	*d*
12,000 sq. yds. granite block	$2.49	$2.63	$2.63	$3.15
1,300 sq. ft. bridgestone	.75	.60	.75	.75
6,000 lin. ft. curb	1.00	.90	.95	1.00
46 sq. ft. 3-in. bluestone	.30	.60	.30	.50
34 sq. ft. 6-in. bluestone	.80	1.00	.80	1.00
144 lin. ft. 12-in. c. i. pipe	1.60	2.25	1.50	1.78
12 sq. ft. W. I. grating	2.00	1.50	2.00	.50
30 lin. ft. 12-in. vitr. pipe	.70	1.00	1.00	1.00
Total	$37,243	$38,214	$38,612	$45,168

Syracuse, N. Y.—Bids will be received Apr. 17 by the Bd. of Contract and Supply for furnishing material and paving with sandstone block on a portion of Dudley St.; bids to include a 10-year maintenance guarantee. Geo. J. Metz, City Clk.

**Albany, N. Y.*—Alonzo Schaupp is stated to have received the contract for improving a portion of Livingston Ave., for $11,087.

**Cortland, N. Y.*—D. J. Conroy, of Oneida, is stated to have received the contract for macadamizing a portion of Tompkins St. for $4,920 or $1.23 per sq. yd. (bids opened Apr. 3).

**Buffalo, N. Y.*—The Bd. of Aldermen is stated to have decided to award the contract for repaving with Medina sandstone a portion of Perry St. to Henry P. Burgard, Prudential Bldg., for $17,000.

**Troy, N. Y.*—John H. Gleason is stated to have received the contract for paving with brick a portion of 15th St. for $29,217, bids opened Mar. 28 by the Bd. of Contract and Supply.

*The contract for repairing the asphalt pavements throughout the city is reported to have been awarded to T. Henry Dumary, of Albany, at $2.91 per yd. for asphalt, and $3.05 per yd. for concrete and asphalt combined.

Rome, N. Y.—Street improvement bonds amounting to $16,696 are reported sold.

Ft. Porter, N. Y.—Bids will be received May 1 by F. F. Jewett, Q. M., U. S. A., for constructing sidewalks here.

Utica, N. Y.—Paul Schultze, City Engr., writes that it is proposed to pave 15 streets with asphalt.

Bucyrus, O.—It is stated that bids will be received, until May 1, by the Bd. Pub. Service for paving about 15,700 sq. yds. with brick; estimated cost $18,800. C. P. Bryant, City Engr.

Melrose, O.—Bids will be received May 8 by W. E. Endsley, Village Clk., for $3,904 Superior and State St. improvement bonds.

Youngstown, O.—It is stated that bids will be received Apr. 28 by G. T. Prosser, City Clk., for constructing cement sidewalks and repairing asphalt streets.

**Toledo, O.*—The Bd. of Pub. Service is stated to have awarded to Kerlin Bros., 416 Nasby Bldg., the contracts for repaving with Logan block portions of Vermont Ave. and Chicago St., for $4,796 and $7,695, respectively.

Cincinnati, O.—Bids will be received May 4 by the Bd. Pub. Service (Geo. T. Holmes, Clk.) for furnishing material and improving a portion of Observatory Ave. by grading, curbing, macadamizing, etc., the top course of macadam to be crushed boulders. Bids will also be received Apr. 19 for furnishing material and improving a portion of Conroy Alley by grading, curbing and paving with brick.

Clairton, Pa.—Bids will be received, Apr. 24, by A. M. Roberts, Boro Clk., for furnishing material and improving a portion of Mitchell Ave. with brick macadam or Telford paving. Approximate estimate: 4,000 cu. yds. excav.; 3,865 lin. ft. stone curb, dressed, or 2,385 lin. ft. curb and gutter, and 1,480 lin. ft. stone curb dressed; 110 lin. ft. rough curb; 6,500 sq. yds. vit. brick pavt., or 3,600 sq. yds. Telford road, and 2,500 sq. yds. vit. brick paving, or 3,500 sq. yds. macadam road and 2,500 sq. yds. vit. brick pavt.

Pittsburg, Pa.—Separate bids will be received by the Dept. Pub. Wks. (Edw. M. Bigelow, Dir.), until Apr. 18, for repaving with asphalt, on portions of 9 streets; repaving with block stone on portions of 29 streets; grading, curbing and paving with block stone on a portion of Birmingham St.; repairing Independence St. and Mansfield Ave.; paving with asphalt on Carver St.

Washington, Pa.—It is stated that bids will be received, until May 6,, by the State Highway Dept., at Harrisburg, for constructing 9,740 ft. of road in Washington County.

Wilkesbarre, Pa.—Bids will be received by Jas. M. Norris, County Controller, on Apr. 29 for constructing a macadam road from Hillside to Huntsville in Jackson Township as advertised in The Engineering Record.

Honesdale, Pa.—E. W. Gammell, Comrs. Clk., at Honesdale, desires some information on the subject of cost, etc., of a macadam road 3,000 ft. long, by 50 ft. wide.

Canonsburg, Pa.—Bids will be received Apr. 17, by the Boro Council (I. B. Linn, Pres.) for improving a portion of College St., by grading, curbing and paving; estimated quantities: 10,000 sq. yds. vitrified brick, or 7,600 sq. yds. of vitrified brick and 2,400 sq. yds. of hillside block, or 10,000 sq. yds. of asphalt block. J. M. Farmer, Boro. Engr.

**Philadelphia, Pa.*—The Mack Paving Co., Land Title Bldg., is stated to have received the contract for paving with shale brick about 4 miles of streets at $1.59 per sq. yd.; the probable cost of the improvement is $150,000.

Carrick, Pa.—Bids will be received Apr. 17 by the Street Comr. for grading, curbing and paving the boule. from Brownsville road to Transverse Ave. Wm. McClurg Donley, Boro. Engr., 1109 House Bldg., Pittsburg.

Ft. Greble, R. I.—Bids will be received by Capt. H. C. Hodges, Jr., Q. M., U. S. A., May 10 for constructing granolithic walks at Ft. Greble, as advertised in The Engineering Record.

Newport, R. I.—See "Miscellaneous."

Nashville, Tenn.—An appropriation has been made for 10,000 sq. yds. bitulithic pavement.

Norfolk, Va.—The Common Council is stated to have passed a resolution providing for an appropriation of $6,527 for paving with asphalt May St., also for $3,653 to macadamize Cooke Ave.

**Tacoma, Wash.*—The following bids are stated to have been opened on Mar. 28 by the Comr. of Public Wks. for constructing cement sidewalks in Buckley addition: H. F. Allen, Seattle, $18,200; W. J. Murphy, Tacoma, $18,180 (awarded contract); F. A. Kearsal, $21,400; Lister & Scott, $22,840; Jas. Lee, $23,900; and R. E. McHugh, $23,333.

Bellingham, Wash.—The City Council is stated to have decided to pave a portion of Holly St.; estimated cost of paving with vitrified brick, $32,390, and with asphaltum, $30,390.

Seattle, Wash.—Bids for regrading 9th Ave. W. are stated to have been received as follows: A. Peterson, $7,794, and S. Normile, $7,457.

The following bids are stated to have been received Mar. 25 for paving with asphalt 6th Ave., W. Stirrat & Goetz, Epler Blk., $19,004, and Barber Asphalt Paving Co., of Seattle, $18,869, and for paving Olympic Pl., Bell & Price, $14,880; Sparger Concrete Co., Lumber Exchange, $14,575; Jas. Markey, $14,618, and Barber Asphalt Paving Co., of Seattle, $14,924.

POWER PLANTS, GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

**Harrisburg, Ark.*—A. A. Boone, of Greenfield, Mgr. Harrisburg Light Co., writes that the Electric Supply Co., of Memphis, Tenn., has secured the contract for constructing the electric light plant at Harrisburg.

San Francisco, Cal.—Leopold Michels, Pres. San Francisco Coke & Gas Co., writes that about $5,000,000 will be expended in improvements. For further information address the engineer, J. C. H. Stut.

Hollywood, Cal.—E. R. Walker, City Clk., writes that the city will install a gas plant, if satisfactory terms cannot be arranged with the Los Angeles Co., to pipe gas here.

San Luis Obispo, Cal.—It is reported that the San Luis Gas & Electric Co. (B. F. Thomas, Mgr., San Luis Obispo) is asking for bids for the construction of an electric light plant to cost $30,000.

Gunnison, Colo.—The citizens are reported to have voted Apr. 4 to issue $100,000 bonds for water works and an electric light plant.

Hartford, Conn.—The Com. on Incorporations has presented a favorable report on a substitute bill authorizing the Hartford City Gas Light Co. to issue $1,000,000 bonds exclusively for funding present indebtedness and improving and extending plant.

Lewiston, Idaho.—Francis Jenkins, of Moscow, is reported interested in the construction of a power plant at Elk Creek Falls.

Weiser, Idaho.—A company is reported organized with Pitts Ellis, Pres., and J. H. Morrison, Secy., to construct a plant and develop the water power on Weiser River, to furnish light and power for Weiser; probable cost of work, $40,000.

The City Clerk writes that there are two propositions under consideration here for power plants on Weiser River, one with A. E. Fox as engineer, for a plant to cost $50,000, the other with C. W. Luck as engineer, for a plant further up the river.

Rockford, Ill.—The Rockford Gas Light & Coke Co. is stated to have purchased a site on S. Avon St., on which it will erect a gas holder with a capacity of 600,000 cu. ft.; it will also expend about $20,000 for new mains.

Chicago, Ill.—It is reported that the People's Gas Light & Coke Co. will expend about $5,000,000 on its plants in this city. The general plan is said to include the installation of an entirely new system of manufacturing gas.

Mishawaka, Ind.—The Indiana & Michigan Electric Co. is about to be formed here to generate power from St. Joseph River and distribute same throughout Indiana and Michigan for lighting and operating trolley lines and for manufacturing plants.

Clear Lake, Ia.—The Electric Light Co. is reported to have secured a franchise for a gas plant.

Casey, Ia.—A. A. Thompson, Recorder, writes that the citizens voted Mar. 27 to construct a gas plant.

Des Moines, Ia.—The Iowa Htg. Co. is reported to have in contemplation extensive improvements.

Webster City, Ia.—O. H. Brown and E. L. Wortham, of Des Moines, are stated to have secured a franchise for a gas plant.

Des Moines, Ia.—It is reported that bids are wanted Apr. 26 for lighting the public parks with naphtha incandescent mantle lamps of not less than 60 c.p. each for the term of 5½ months from May 1 to Oct. 15, 1905. J. W. Campbell, Chmn. Bd. Pub. Wks.

**Waverly, Kan.*—Contracts for contracting an electric light plant (bids opened Apr. 3) have been awarded as follows (Engr., W. K. Palmer, Dwight Bldg., Kansas City, Mo.): For engine, boiler, pipe and fittings, English Iron Wks., Kansas City, Mo.; generator exciter and switchboard, Hodge-Walsh Electrical Co., Kansas City, Mo.; heater, trap separators, feed pump, étc., Kansas City Eng. Co., and lamp and pole line equipment to the B-R Electric Co., of Kansas City, Mo.

Kingman, Kan.—W. K. Palmer, Kansas City, Mo., has completed plans and specifications for a hydro-electric power station for the Kingman Light & Power Co. The plant will be operated by means of water power derived from the Minnescah River and a reserve power installation in the shape of a gas engine and suction gas producer.

Carlisle, Ky.—A company is reported organized here with C. C. Cole, Pres. and Geo. A. Straus, Secy., to construct an electric light plant at a cost of $15,000.

Lawrenceburg, Ky.—Bids will probably be seceived with 30 days for the proposed electric light plant which will cost $12,000. Address W. E. Dowling, of the Commercial Club.

Homer, La.—Chas. H. Levy, Consulting Engr. Shreveport, writes that it is proposed to construct water works and an electric light plant at Homer, at a cost of $20,000.

Lake Charles, La.—It is reported Mayor C. H. Winterhaler will receive bids Apr. 19 for furnishing the city with electric lights; also for the sale of the franchise for the use of streets for electric lighting.

Portland, Me.—The Cascade Light & Power Co. has been incorporated with a capital of $100,000 to manufacture gas and electricity. C. A. Hight, Pres., Boston, Mass.; L. L. Hight, Secy., Portland.

Bradley, Me.—Local press reports state that Fred. W. Ayer, of Bangor and associates will construct an electric plant for the manufacture and storage of electricity for power purposes at Bradley or Ellsworth.

**Holyoke, Mass.*—W. H. Snow, Mgr. Gas & Electric Light Dept., writes that Cruse-Kemper Co., Stephen Girard Bldg., Philadelphia, Pa., has secured the contract for a 750,000 cu. ft. gas holder (bids opened Mar. 20) for $52,750.

The Holyoke Water Power Co. (R. C. Winchester, Treas.) is reported to be completing plans for utilizing the surplus water of Connecticut River; it is proposed to expend about $60,000.

Ft. Brady, Mich.—Bids will be received by Lieut. C. S. Hoffman, Q. M., U. S. A., May 3, for furnishing and installing interior and exterior electric light fixtures and wiring, and supplying current here for 1 yr. beginning July 1 with privilege of renewal, as advertised in The Engineering Record.

St. Paul, Minn.—The Union Mfg. Co. has secured a franchise to extend its lighting system west of Fort St. and Seven Corners and south of University Ave.

Torah, Minn.—The Torah Telephone & Improvement Co. is reported incorporated, to construct water works, an electric light or gas lighting plant and telephone exchange. F. Wurst, Pres. R. F. Zemle, Secy.

Minneapolis, Minn.—Jos. L. Kuchle is reported to have filed with the city a bond and acceptance by the Minnesota Power & Trolley Co., of the ordinance granting the right to use the city streets for conduits and poles, to convey electric energy to the city, and to supply electric light and power to consumers. The company agrees to begin actual work on construction and expend at least $200,000 within one year.

Fairmont, Minn.—The citizens are reported to have voted, Apr. 4, to issue $18,000 bonds for improving the electric light plant and for water works and $10,000 for a sewerage system.

Meridian, Miss.—It is reported J. H. Rives, Mayor, will receive bids May 1 for furnishing 200 arc lights, 1,200 c. p. for a period of 5 years from May 1, 1906; 200 or more alternating-current enclosed arc lamps, 66 amperes each; potential of not less than 72 volts between terminals of each arc lamp and an apparent wattage of 475 apparent watts for each lamp; lamps in business section to burn all night, others to run on moonlight schedule. Franchise will be granted to successful bidder.

Madison, Mo.—The citizens are reported to have voted Apr. 4 to issue $5,000 bonds for an electric light plant.

Marshall, Mo.—A. H. Bickmore & Co., of New York, N. Y., are reported to have purchased the electric light plant and gas plant at Marshall. The two plants will be consolidated and extensively improved.

New York, N. Y.—Bids will be received Apr. 20 by Geo. E. Best, Comr. Bridges, for the construction and equipment of an electric lighting station, Tompkins St. and Delancy Slip, Boro. Manhattan, for the Williamsburg Bridge.

Bids will be received Apr. 18 by the Dept. Pub. Charities (Jas. H. Tully, Comr.) for electric installation, Metropolitan Hospital, Blackwell's Island.

Brooklyn, N. Y.—Bids will be received Apr. 24 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for installing electric equipment in the Commercial High School.

Albany, N. Y.—The annual supply bill prepared by the Assembly Ways & Means Com. contains an appropriation of $52,000 for the purchase and installation of an electric light plant for the state buildings.

The Common Council has passed a resolution providing for the appointment of a committee of 5 to investigate the subject of a municipal lighting plant; also to appropriate the money to carry on the investigation and employ an electrical expert. Comr. of Pub. Wks. Bissell estimates the cost of constructing such a plant at $296,000 and $121,000 per year to operate same.

Tonawanda, N. Y.—The Niagara, Lockport &

**Items marked thus give the names of parties awarded contracts.*

Ontario Power Co. is stated to have petitioned Council for a franchise.

Wheatfield, N. Y.—The Niagara, Lockport & Ontario Power Co. is reported to have petitioned the Village Trus. for a franchise in Wheatfield.

Salamanca, N. Y.—C. F. Buckmaster, City Clk., writes that the citizens have voted to purchase the electric light plant and water works.

Philmont, N. Y.—The Philmont Gas Co. is reported formed, with a capital of $15,000 to construct a gas plant. Directors: Henry T. Duke, Philadelphia, Pa.; Seldon D. Kane, Binghamton, and Vaughan W. Duke, Brooklyn.

Springville, N. Y.—Bids will be received by Ira W. Smith, Village Clk., Apr. 22, for $12,000 electric light bonds.

Rochester, N. Y.—The question of establishing a plant for generating electricity for use at the Mechanics Institute, is reported under consideration by the directors.

Grand Forks, N. D.—The citizens are reported to have voted Apr. 3 to issue $30,000 bonds for the construction of a municipal electric light plant.

Lockland, O.—The citizens are reported to have voted to issue $27,000 bonds for extending water mains and enlarging the electric light plant.

Reading, O.—The citizens are reported to have voted Apr. 3 to issue $28,000 electric light bonds.

Madison, O.—The Geneva Illuminating Co., of Geneva, has petitioned Council for a franchise to light the city from its plant at Geneva which is 6 miles distant. W. A. Scott, City Clk.

Bellefontaine, O.—Fred Spittle, City Clk., writes that the citizens voted Apr. 10 to issue $50,000 bonds for improving the electric light plant.

Barnesville, O.—It is reported bids are wanted until Apr. 20 for lighting the village with gas and electricity for a period of 5 years. E. M. Wilker, City Clk.

Scranton, Pa.—The West Scranton Light, Heat & Power Co., is stated to have petitioned Council for a franchise to string wires and lay conduits and pipes especially on the west side. This company has been incorporated with a capital of $50,000 by Wm. T. Davis, Thos. P. Gordon, and others.

Edgefield, S. C.—The question of constructing water works and an electric light plant is reported under consideration here.

Bamberg, S. C.—The citizens voted Apr. 3 to grant to D. J. Howell, C. E., Huyler Bldg., Washington, D. C., and associates, a franchise for water works and an electric light plant.

Collierville, Tenn.—Kirkpatrick & Johnson, of Jackson, Miss., has been selected to prepare plans for an electric light plant for Collierville.

Nashville, Tenn.—It is reported that bids are wanted Apr. 18 by the Bd. Pub. Wks. for furnishing one 250-kw generating unit and accessories for the city lighting plant, generators to be of the type manufactured by the Westinghouse Electric & Mfg. Co., or the Bullock Electric Co., to be direct connected to a Fleming 4-valve tandem compound engine. J. W. Pentecost, Supt. Electric Light Plant.

Logan, Utah.—Shepherd, Monson & Schaub, Civil Engrs., are reported to have decided to install a power plant of 500-h.p. in Cache Co.

**Richmond, Va.*—S. W. Bigger, Clk. State Capitol Comn., writes that W. A. Chesterman and the Morrison Machinery & Supply Co. have secured contracts for installing a heating, light and power plant for the State Capitol Bldgs and Grounds (bids opened Apr. 4) for a total cost of $30,263.

Tacoma, Wash.—A McL. Hawkes is stated to have submitted a proposition to the city to construct an electric power plant for $600,000.

Kelso, Wash.—Mr. Harris, Mgr. Kelso Water & Light Co., writes that it is proposed to construct an electric light plant at a cost of $10,000, but company is not yet ready to consider bids. Engr, C. P. Henricksen.

Aberdeen, Wash.—Reid & Briggs, are reported to be preparing plans for an extensive addition to the plant of the Grays Harbor Lighting Co. at East Aberdeen. E. A. Bradner, Ch. Engr., Hoquiam.

Ballard, Wash.—The Ballard Electric Co. (Fred G. Simpson, Mgr.) is reported to have secured a new franchise, and will make extensions.

Grand Rapids, Wis.—The Boom Co. is reported to have granted Wm. Holmes, of Menominee, Mich., permission to construct a dam for water power purposes at Grand Rapids.

Kenosha, Wis.—Mayor Jas. Gorman is reported to have begun a movement in this city to secure a municipal lighting plant. The present contract expires in two years.

Stoughton, Wis.—The citizens are reported to have voted Apr. 3 to issue $25,000 for a municipal lighting plant.

Milwaukee, Wis.—Howland Russel, 106 Mason St., is reported to be preparing plans for a central power plant for the Milwaukee-Downer College, probable cost of building and equipment, $10,000.

Grand Falls, B. C.—The Grand Falls Power Co. is reported incorporated with a capital of $200,000 by Sir Wm. C. Van Horne, of Montreal, Que., Hugh Havelock MacLean, of St. John, N. B., Frank C. Partridge, of Proctor, Vt., and others, to construct, equip, maintain and operate a canal and hydraulic raceway at Grand Falls.

Nuevo Laredo, Mex.—A company is reported as being formed by Octaviano Gonzalez and associates, with a capital of $30,000, to construct an electric light plant at Nuevo Laredo.

**Calgarry, N. W. Ter.*—F. W. Thorold, City Engr., writes that contracts for consructing an electric light plant (bids opened Mar. 15) have been awarded as follows: 2 Babcock & Wilcox boilers, 250 hp., with feed pump all set up and running, to Babcock & Wilcox, Montreal, Que., for $13,150, and for a 350-hp. compound Corliss engine, with condenser, heater, etc., all running, to the Robb Eng. Co., of Amherst, N. S., for $9,574.

Charlottetown, P. E. I.—W. W. Clark, City Clk., writes that it is proposed to apply to Legislature for permission to construct electric light plant; probable cost $75,000.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Lexora, Ark.—See "Railroads."

Siloam Springs, Ark.—The Siloam Springs Electric R. R., Power & Improvement Co. is stated to have decided to construct an electric railway from Siloam Springs to a point 12 miles east of the Illinois River, and there to establish a power plant. D. Zimmerman, Pres.; R. J. Alfrey, Secy., and E. C. McCulloch, Treas.

Oroville, Cal.—The Northern California Ry. & Navigation Co. is stated to have received a franchise to construct an electric railway between Chico and Oroville.

Bunker Hill, Ill.—The construction of an electric railway between East Alton and Litchfield, is reported under consideration. J. H. Belt, Pres., H. R. Rudd, Secy. The line will extend from Litchfield to East Alton, parallel with the Big Four tracks. At East Alton it will connect with the Alton-Granite City Electric Ry.

Chicago, Ill.—Bids will be received by the City Comptroller, on July 1, for the construction and installation of a system of municipal street railways within the city of Chicago, as advertised in The Engineering Record.

Alton, Ill.—It is stated that the Big Four is considering a plan to equip as an electric railway the branch between Alton and East Alton.

New Albany, Ind.—The Louisville & Southern Indiana Traction Co. is stated to have completed the survey of its route between this city and Carrydon, a distance of 26 miles.

Warsaw, Ind.—It is stated that the Traction Company of America contemplates constructing an electric railway between Ft. Wayne and Warsaw, and that work of constructing the line will begin soon.

Mt. Vernon, Ind.—It is stated that the Evansville & Princeton Traction Co. has under consideration the construction of an extension to Mt. Vernon.

Lafayette, Ind.—The Fountain-Warren Traction Co. is stated to have decided to build a line from this city to Covington and the adjacent coal fields. Chas. M. McCabe is reported interested.

The Lafayette & Southwestern Traction Co. is reported to have under consideration the construction of an electric railway from this city to the coal fields near Covington. Capital, $1,000,000.

Ottumwa, Ia.—Attorney A. A. McGarry and J. N. Casady, of Des Moines, are reported interested in a proposed electric railway to connect Ottumwa and Des Moines. The line proposed will be about 80 miles in length, and will touch the coal fields of Marion, Mahaska, Monroe and Wapello Counties.

Sumner, Ia.—The officials of the Waterloo and Cedar Falls Rapid Transit Co. have announced that they intend to construct about 60 miles of new road this summer. This company operates an electric interurban line between Waterloo, Cedar Falls and Waverly, Ia., and a steam road between Waverly and Sumner.

Des Moines, Ia.—It is stated that surveys for the St. Joseph, Albany & Des Moines Electric Ry. are being prepared and the line will be constructed, as the promoters seek connections between Kansas City and St. Joseph and Minneapolis and St. Paul.

Lynn, Mass.—It is stated that the Nahant & Lynn St. Ry. Co. contemplates constructing an electric railway between Nahant and Lynn. Walter H. Southwick is reported interested.

Boston, Mass.—It is stated that the Boston & Northern St. Ry. Co. contemplates expending $100,000 for extensions and improvements.

Paterson, N. J.—The New York & New Jersey Rapid Transit Co. is stated to have on Apr. 3, at a meeting of the Bd. of Aldermen, presented a petition granting the company the right to cross certain streets and to erect on Pearl St. and Fifteenth Ave., from Straight St. to a point between E. 18th St. and Madison Ave., an elevated structure which is to be a part of the third-rail electric railway which the company proposes to construct between this city and the Hudson River, opposite New York.

New York, N. Y.—See "Water."

Long Island City, N. Y.—It is reported that the New York & Queens County Ry. Co. contemplates constructing a new route from Long Island City to Jamaica. According to report, this line will run from Jackson Ave. to Thompson Blvd., to Hoffman Blvd. to Jamaica.

Cohocton, N. Y.—Geo. H. Switzer, of Bath, is stated to have received franchises to construct a 10-mile electric railway from Atlanta to Woodville, via North Cohocton and Naples.

Lima, O.—The Lima & Toledo Traction Co. is reported incorporated with $50,000 capital by Jos. B. Mayer, J. A. Bendure, D. J. Cable, W. B. Richie and B. A. Connelly. The company proposes to build from Lima to Toledo, paralleling the Cincinnati, Hamilton & Dayton R. R., and passing through the villages of Columbus Grove, Ottawa, Leipsic, Bellaire, Deshler, Tontogany, Perrysburg, Waterville and Maumee. An effort will be made to build the line as far as Leipsic this year. J. A. Bendure, of Lima, is in charge of the work.

Cleveland, O.—It is reported that the Cleveland & Southwestern Traction Co. contemplates constructing an extension to Mansfield this year.

It is stated that the Cleveland Electric Ry. Co. contemplates extending its line on Woodland Hills Ave. to provide entrance to Luna Park.

Mansfield, O.—Col. W. W. Cockley, of Lexington, O., is reported interested in the construction of a line from Mansfield to Lexington, Bellville, Fredericktown and Mt. Vernon.

Zanesville, O.—It is stated that the Southeastern Ohio Ry., Light & Power Co., will start construction work on the line to Crooksville, Apr. 15. Practically all the right of way has been secured. Franchises have just been granted in Zanesville and Roseville. Others interested in this proposition are Alfred Caldwell, L. G. Halleck, S. S. Bloch, J. A. Block and J. G. Hoffman, of Wheeling.

West Chester, Pa.—The West Chester St. Ry. Co. is stated to have decided to construct the following extensions from West Chester to Coatesville, a distance of 14 miles; from Willowdale to London Grove, and from High St., West Chester, to Wilmington, Del.

Scranton, Pa.—The Northern Electric St. Ry. Co. contemplates extending the road to Glenburn.

The Northern Electric St. Ry. Co. is stated to have received a franchise to construct its road along West Market St., Pres., Dr. A. J. Connell; Secy. and Treas., Col. Ezra H. Ripple.

Bellefonte, Pa.—The Bellefonte Trolley Co. is stated to have received franchises from the boroughs of Bellefonte, Milesburg and State College, and surveys are being made for a route from Milesburg through Bellefonte to the College.

Jersey Shore, Pa.—The Jersey Shore-Antes Fort Ry. Co. is stated to have decided to begin work at once on the extension from Antes Fort to Nippeno Park.

Pottsville, Pa.—The Pottsville, Frackville & Shenandoah Ry. Co. contemplates purchasing the interests of the Schuylkill Traction & Lakeside Electric Ry. Co., and according to reports will construct a third-rail line between Shenandoah and Pottsville, via Maizeville and Frackville, with an extension to the Miners' Hospital at Fountain Springs.

Latrobe, Pa.—It is stated that the Westmoreland R. R. Co. contemplates constructing an extension to Greensburg, the line to be 10 miles long; also a branch to Blairsville, a distance of 8 miles.

Concord, Tenn.—The East Tennessee Electric Ry. Co. has secured a franchise to construct an electric railway from Knoxville to Concord. John T. Eubanks, of Concord, is reported interested.

Walla Walla, Wash.—The construction of an electric railway from Walla Walla to Wallula is reported contemplated by the Inland Empire Traction Co. Geo. W. Armour is reported interested.

Oconomowoc, Wis.—The Milwaukee Light. Heat & Traction Co. is stated to have received a franchise to construct an electric railway over certain streets, and the road will be extended from Waukesha Beach to Oconomowoc.

Manitowoc, Wis.—It is stated that the Fox River Ry. Co. contemplates starting construction work on the interurban electric railway, running from Sheboygan to Manitowoc, thence west through Reedsville, Brillion, Forrest Junction to Kankana—the line to be 60 miles in length. Capital, $2,250,000. Isaac A. Smith, Ch. Engr. of Constr., 21 Torrison Blk.

New Westminster, B. C.—A proposition to build an electric railway from New Westminster to Steveston is stated to have been submitted to the British Columbia Electric Ry. Co.

London, Ont.—The London, Chatham & Western Ry. Co. is reported to have under consideration the construction of an electric railway from London to Windsor.

Toronto Ont.—The Toronto & Hamilton Electric Ry. Co. is reported to be receiving bids, May 1, for the grading, culverts, masonry, bridges and other works required between Toronto and Niagara Falls. Plans and specifications may be seen at the Engineering Dept., Pacific Bldg., Scott and Front Sts., Toronto, Ont.

St. Thomas, Ont.—The Strathroy & Western Counties Co. is stated to have under consideration the extension of its line between Strathroy and St. Thomas, passing through the city of London.

Montreal, Que.—It is stated that the Park and Island section of the Montreal St. Ry. will be extended to Ste. Anne's and around the Island of Montreal to Cartierville and Riviere-des-Prairies, thence to St. Vincent-de-Paul.

RAILROADS.

Notes Arranged Alphabetically by States.

Stevenson, Ala.—The Southern Ry. Co. (W. H. Wells, Ch. Engr., Washington, D. C.), is reported to have decided to begin building an extension of its Memphis Division from Stevenson to Chattanooga within the present year.

Traskwood, Ark.—The Dalhoff Constr. Co., of Little Rock, is stated to have secured the contract for constructing the Frisco Line from Traskwood to Crossett, and a branch to El Dorado, a total distance of 140 miles; probable cost of work, $1,750,000.

Pine Bluff, Ark.—The Pine Bluff North & South R. R. Co. is reported incorporated with a capital of $600,000, to build a road from Pine Bluff to Lonoke, a distance of 46 miles. Incorporators: E. C. Howell, Wm. Nichols, W. N. Trulock and others.

Luxora, Ark.—The Luxora, Jonesboro & Western R. R. Co. has been incorporated with a capital of $500,000, to build from Luxora to Jonesboro, a distance of 45 miles. Incorporators: R. McCreey, of Black Rock; Jo and W. B. Calhoun, of Luxora, an The company is chartered to constr a steam or electric line.

Warren, Ark.—The Warren & DeVa R. R. Co. has been incorporated with of $1,000,000 to build a line 90 m from Warren to DeVall's Bluff. passes through Bradley, Cleveland, Lonoke and Prairie Counties. Incor W. T. Thompson, J. G. Thweatt, W. son and others.

Wilmington, Del.—The Philadelphi more & Washington R. R. Co.) W. H Ch. Engr., Philadelphia, Pa.), is stated decided to expend about $10,000,000 in its tracks through Wilmington, Del., at the approaches to the Washington Station, and new bridge over the Susq and for other minor improvements a equipment.

Columbus, Ga.—Application for cha been filed in Chambers County, Ala., Columbus & Anniston R. R. Co. Th porators desire the privilege of constr road from Columbus to Attalla, Ala.

Waycross, Ga.—Press reports state Atlantic Coast Line Ry. Co. will expen $400,000 in improvements in its line cross. E. B. Pleasants, Ch. Engr., ton, N. C.

Springfield, Ill.—The Chicago & Alto Co. (G. H. Kimball, Ch. Engr., Chicago ported to be preparing to reduce the g its line on the Peoria Division, between field and Peoria. The work will cos $300,000.

Shawneetown, Ill.—Articles of incor for an extension of the Illinois Central (H. U. Wallace, Ch. Engr., Chicago, Ill. Shawneetown to Golconda, Ill., have bee A branch is planned from Fairview Min bin County, to the Ohio River.

Moline, Ill.—The Council is stated t adopted a resolution requesting the Rock R. R. (W. L. Darling, Ch. Engr., Chicag and the Burlington R. R. (T. E. Calve Engr., Chicago, Ill.) to remove their tr the river front.

Fulton, Md.—The Western Maryland Co. (J. Q. Barlow, Ch. Engr., Cumbe is reported to be arranging to double-tr line from Fulton Station to Emory Gr distance of about 17 miles.

Marquette, Mich.—It is stated that the quette & Southeastern R. R., controlled Cleveland Cliffs Iron Co., will be extended of Marquette to Big Bay, a distance of 25 this season. W. F. McKnight, of Rapids, and Rush Culver, of Marquette, ported interested.

Jersey City, N. J.—Press reports state th Erie R. R. Co. (C. W. Buchholz, Cons Engr., New York, N. Y.), will expend s millions in extending its facilities in this

Niverville, N. Y.—The New York C R. R. Co. (Henry Fernstrom, Ch. Engr. York, N. Y.), is reported to have decid build a third track between Niverville Brookview, 8 miles, and between East Ch and Canaan, 4 miles.

Schenectady, N. Y.—The Annual Supply prepared by the Assembly Ways and Means at Albany, is reported to contain an appr tion of $75,000 for abolishing the grade ings at Schenectady.

Cincinnati, O.—An ordinance for the abo of grade crossings on the first section of Pennsylvania R. R. (W. H. Brown, Ch. E Philadelphia, Pa.), was introduced in Co Apr. 3, and referred to the Committee on Elevation and Subways.

Pittsburg, Pa.—The engineering corps of Wabash R. R. (W. S. Newhall, Ch. Engr. Louis, Mo.) is reported to have made a in the neighborhood of Centerville for the tension of the line from Pittsburg through undeveloped coal fields of Washington Greene Counties to the line of the West ginia Central. A connection will be made with the Maryland Central and tide water be reached at Baltimore.

Burgettstown, Pa.—The Pittsburg, Cincin Chicago & St. Louis Ry. Co. (Thos. Rodd, Engr., Pittsburg) is stated to be about to av contracts for a change of alignment of main track between Burgettstown and Bulger, a tance of about 3 miles; the work will cost al $400,000.

Pitcairn, Pa.—The Pennsylvania R. R. (W. H. Brown, City Engr., Philadelphia) stated to have decided to expend about $200, at its yards in Pitcairn, the work to be in cha of Supervisor C. H. Niemeyer.

**Fairmount, Pa.*—T. P. McManus & Co., Philadelphia, are reported to have secured contract for building a branch of the Penn vania R. R., to connect Perryville and F mount, a distance of 8 miles.

Philadelphia, Pa.—The Directors of Northern Central R. R. Co., at a meeting Philadelphia, on Apr. 7, authorized an exper ture of $289,000 for building a fourth track tension between Wago and Fall's yard; $2 for building a telegraph line between Fairv and Wago, and $298,000 for building the between New Cumberland and the Fairv yards, including the strightening of the near Bridgeport. W. H. Brown, Ch. Eng Philadelphia.

Ft. Worth, Tex.—It is stated that arran ments have been completed for the extens to the Gulf of Mexico of the Colorado & Sou ern Ry. (H. W. Cowen, Ch. Engr., Den Colo.), which is controlled by Edwin Haw and his associates. From Ft. Worth to the G at Galveston, the new through line will be p vided for by the acquisition of the Trinity Brazos Valley Ry., 79 miles long, running fr ith of Ft. Worth, to Mexia, Tex., truction of about 160 miles of new eeting the cost of the projected ex- ated at from $8,000,000 to $8,000,- rado and Southern will issue bonds.

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*Items marked thus give the names of parties awarded contracts.

.—The former project of the Dal- exico Ry., which was graded about Dallas northwest about 70 miles, is l and it is stated that soon appli- e made to the Railroad Comn. to in advance of construction, which to finance and complete the work. Vice-Pres., Dallas.

, *Tex.*—Final surveys are reported or the early construction of the cut- anta Fe Ry. from Brownwood to a distance of about 300 miles. This ection with the extension from Rio M., on the Pacific line, to a point Valley Ry., at or near Portales, greatly shorten the Santa Fe Route lf of Mexico to the Pacific. The r the general direction of Jas. Dun, opeka, Kan.

Vash.—The Republic & Kettle Val- is reported to have changed its Spoken & British Columbia Ry. Co., reased its capital from $1,000,000 . The increase is made to provide nsion from Republic to Spokane. rington, Cr. Engr., Grand Forks,

Wash.—Cochran & Woolson, of nn., are stated to have secured a n the Great Northern R. R. to straighten its main line 6 miles east Wash., at a cost of about $100,000.

Wis.—The Chicago & Northwest- . (E. C. Carter, Ch. Engr., Chicago, rted to have decided to build an een Milwaukee and Chicago during summer. The road will run from outside of Milwaukee, to a point ern limits of Chicago.

uba.—The Havana Central R. R. ted incorporated, with a capital of o build and operate railroads in porators: Frank J. Hammers and ary, Brooklyn, N. Y.; Henry M. ersey City, N. J.; Benson S. Cur- auncey Blair Spears, New York,

PUBLIC BUILDINGS.

ranged Alphabetically by States.

n, Ala.—Bids will be received by Perkins, Q. M., U. S. A., May onstruction of a boat house at Ft. advertised in The Engineering

riz.—Bids will be received by Capt. alcutt, Jr., Q. M., U. S. A., May truction, plumbing, steam heating wiring of 18 buildings, as adver- Engineering Record.

Ark.—It is stated that bids will be Apr. 27 for erecting a court house. . Jackson, Miss., is the archt.

Cal.—Dr. P. L. Wheeler, Trus. ritt Hospital, writes that bids will received the latter part of April the hospital at Oakland, at a cost o,ooo. Architect, Nathan Blaisdel, St., San Francisco.

Colo.—Link & Carter, of Butte, been selected to prepare plans for to the State Deaf and Dumb Asy- der, the erection of which will cost

Conn.—It is stated that the Coun- d a bill appropriating $124,000 for and furnishing of a municipal

n, Del.—It is reported that improve- be made to the court house at a t $100,000.

on, D. C.—B. A. & G. M. Williams, 2d St., New York, N. Y., have se- ntract for stone for the municipal $644,001. South Dover white mar- ised.

Ga.—It is stated that bids will be il Apr. 20 by the Bd. of Roads and Kirby S. Anderson, Chmn.), for urt house.

ho.—It is reported that the Cap- omrs. will receive plans and speci- the capitol which is to be erected $350,000.

Ill.—Father Bruin is said to be the erection of a hospital here to 20,000.

.—It is reported that a building cted for the St. Joseph R. C. Hos- M. Salesia, Superior), at a cost

ll.—At the election held Apr. 4th, d, that the citizens voted in favor $5,000,000 bonds to erect a new ing.

, Ind.—A. E. Pinkey, Co. Aud., Eric Lund, of Hammond, has se- ntract for erecting the Court House, umbing and heating. (Bids opened ontract price is reported to be $27,-

Ind.—It is reported that the Bd. s. will receive bids May 16 for erect- om infirmary and hospital bldg.

**Glenwood, Ia.*—F. S. Treat, Secy. State Bd. of Control of Institutions, Des Moines, writes that the contract for erecting several buildings at the Glenwood Institution (bids opened Apr. 4) has been awarded to W. W. Welch, of Clarinda, for $23,478.

**Des Moines, Ia.*—Benson & Marxer, 425 Grand Ave., it is stated, have received the contract for building inside partition walls at the court house which will require the laying of about 200,000 brick.

Oswego, Ky.—The Daviess Fiscal Court has voted to appropriate $16,000 for the erection of an armory in this city.

Monroe, La.—The City Council has passed an ordinance appropriating $25,000 for the purchase of a site on which to erect a city hall. The cost of the building is to be about $50,000.

Biddeford Pool, Me.—Bids will be received Apr. 21 by S. I. Kimball, Gen. Supt., Treas. Dept., U. S. Life-Saving Service, Washington, D. C., for constructing a life-saving station at Fletcher Neck, Biddeford Pool, Me.

Bangor, Me.—Archt. Frank A. Bourne, Room 96, Mason Bldg., Boston, Mass., writes that bids will be received on Apr. 26 for erecting a public library in Bangor, to cost about $125,000.

Hyde Park, Mass.—The Town Officials are reported to be agitating the question of erecting a new town hall.

Holyoke, Mass.—The erection of an armory for Co. D., at a cost of about $30,000 is reported under consideration.

Marlboro, Mass.—The Governor Council, it is reported, has approved the plans submitted by J. Lawrence Berry, of Boston, for the Armory for Co. F, 6th Regt., which is to cost about $22,000. It is reported that bids will soon be asked by Mayor Jos. N. Peterson, of Salem, Chmn. Armory Comrs., for the erection of the building.

Springfield, Mass.—The City Library Assoc., it is reported, has announced that Andrew Carnegie has agreed to give $150,000 to the Assoc. for the erection of a library.

Detroit, Mich.—Bids will be received May 2 by Jas. Knox Taylor, Superv. Archt., Washington, D. C., for the extension of the lookout gallery in the U. S. Court House and Post-Office here.

Flint, Mich.—The late Jas. J. Hurley, it is reported, has bequeathed to this city a site and about $25,000 in cash for the purpose of erecting a general hospital.

Kalamazoo, Mich.—The citizens have voted in favor of erecting a heating plant to heat the county buildings.

Cadillac, Mich.—The citizens have voted in favor of erecting a court house.

Worthington, Minn.—The business men and citizens are said to be considering the erection of a hospital to cost $20,000. Ned Jones may be able to give further information.

Minneapolis, Minn.—F. G. Corser, N. Y. Life Bldg., it is stated, has prepared plans for an addition to the Home for the Aged which is to be erected at 2d St., N. E. and B'way at an estimated cost of $25,000.

Winona, Minn.—Seidlitz & Werner, it is reported, submitted the lowest bid for erecting the poor house at $20,900.

Duluth, Minn.—The Co. Comrs. are considering the erection of a new court house.

Ellisville, Miss.—The Bd. of Superv., it is reported, is considering the erection of a court house at a cost of $50,000.

Sedalia, Mo.—Bids will be received Apr. 19 by the Dirs. of the Missouri State Fair (J. R. Rippey, Secy., Sedalia) for erecting the following brick buildings: 2 cattle barns, 65x159 ft.; a poultry bldg., 80x160 ft.; a live stock pavilion, 177x234 ft., and addition to steel grand stand, 70x160 ft. T. W. Bast, Archt., Sedalia.

Lexington, Mo.—The citizens have voted in favor of issuing $20,000 bonds to erect a city hall.

Ft. Assinniboine, Mont.—Bids will be received until May 11 by Capt. J. B. McDonald, Constr. Q. M., Ft. Assinniboine, for furnishing material and constructing a basement and smokestack, and installing a heating plant and plumbing system in the hospital here.

Red Bank, N. J.—Bids will be received Apr. 21 by S. I. Kimball, Gen. Supt., Treas. Dept., U. S. Life-Saving Service, Washington, D. C., for making repairs, alterations and additions to the South Brigantine, N. J., Life-Saving Station.

Trenton, N. J.—It is reported that the Governor has signed the bills appropriating $250,000 for improvements to the prison at South Trenton and $250,000 for additions to the State Hospital.

Summit, N. J.—Dr. Geo. M. Shinn, it is reported, is interested in the erection of a hospital here, at a cost, including equipment, of $25,000.

New York, N. Y.—See "Water."

New York, N. Y.—Bids will be received Apr. 19 by John F. Ahearn, Boro Prest., for work in connection with the County Court House, City Hall Park, including masonry, iron work, concreting, roofing, galvanized iron work, marble and plumbing work. Bernstein & Bernstein, Archts., 72 Trinity Pl.

Plans have been filed for a 2-story brick laundry and kitchen to be erected on Harts Island, for the City of New York, at a cost of $25,000. Edward H. Lippe, Archt., 22 E. 21st St.

New York, N. Y.—See "Water."

Brooklyn, N. Y.—Bids will be received Apr. 24 by Nicholas J. Hayes, Fire Comr. N. Y. City, for furnishing material and making alterations to the quarters of Hook & Ladder Co. No. 51 and Engine Co. No. 102, in the Boro. of Brooklyn.

**Rochester, N. Y.*—The Hudson Valley Constr. Co., of Troy, has secured the contract for the entire construction of the State Armory at Rochester (bids opened Mar. 21); appropriation $300,000. For further information address the Hudson Valley Constr. Co., at its main office, 208 Times Bldg., Troy. For list of bids received for this work see issue of The Engineering Record, Apr. 1.

*According to press reports contracts for portions of the work in connection with the above building have been awarded as follows: Structural steel, Buffalo Structural Steel Co., Buffalo, $33,414; heating, J. S. Goodenow, Utica, $7,840; plumbing, Barr & Creelman, Rochester, $10,035; wiring, fixtures, gas piping, etc., Standard Electric Constr. Co., Rochester, $9,990.

Rockaway Beach, N. Y.—Fire Com. Hayes, N. Y. City, it is reported, has authorized the erection of 3 brick fire houses here and 2 in Far Rockaway, the cost to be about $50,000 each.

Watertown, N. Y.—The plans of D. D. Kieff, 24 Flower Bldg., it is stated, have been accepted for the brick and stone building which is to be erected at the St. Joachim's Hospital at a cost of $20,000.

East View, N. Y.—It is reported that about 75 acres have been purchased here for a Solomon and Betty Loeb Memorial Home for Convalescents. The plans contemplate the erection of a number of detached cottages. A fund of $750,000 has been given, of which $250,000 will be used for the erection and equipment of the buildings. Morris Loeb is Pres. of the Bd. of Trus.; Paul M. Warburg, Secy.

Elmira, N. Y.—Governor Higgins has signed the bill appropriating $115,000 to replace the buildings at the reformatory which were recently destroyed by fire.

Utica, N. Y.—Governor Higgins has signed the bill increasing the fund for the construction of a court house nere, the amount appropriated being $520,000.

Beaufort, N. C.—W. L. Arrington, Register of Deeds and Clk. Co. Comrs., writes that bids are wanted for remodeling and enlarging the Court House and building a jail. No architect selected as yet.

Raleigh, N. C.—The Directors of the State Hospital for the Insane, it is reported, have appointed a Bldg. Com., of which John W. Thompson, is Chmn., to have charge of the erection of an addition to the hospital buildings for which the Legislature has appropriated $40,000.

Cincinnati, O.—Bids will be received Apr. 20 by the Bd. of Pub. Safety (Clifford F. Lakeman, Secy.) for erecting a 2-story brick engine house on Court St., bet. Plum and Central Aves., including masonry, brick, iron and cement work, plumbing and gas fitting, electric wiring and hot water heating; separate bids to be submitted for the iron work. Harry Hake, Archt., Union Trust Bldg.

Hamilton, O.—Bids will be received Apr. 18 by the Bd. Pub. Service (John B. Connaughton, Clk.) for furnishing material and erecting a brick addition to the electric light plant building.

Steubenville, O.—Bids will be received Apr. 22 by Geo. P. Harden, Co. Aud., for $50,000 county infirmary bonds.

Mansfield, O.—The plans of Vernon Redding, of Mansfield, have been accepted for the library which is to be erected at a cost of $35,000.

Oil City, Pa.—Bids will be received by the Superv. Archt., Treas. Dept., Washington, D. C., May 22 for the construction complete of U. S. Post Office at Oil City, as advertised in The Engineering Record.

Philadelphia, Pa.—Local press reports state that Director Smyth has announced that bids are soon to be asked for the erection of hospitals for the treatment of diphtheria and scarlet fever, for which $900,000 is available.

Newport, R. I.—A bill has passed the Senate authorizing this city to secure a site and erect a convention hall at a cost of $50,000.

Lead, S. D.—Bids will be received until Apr. 25 by Thos. M. Goddard, Commandant, South Dakota Soldiers' Home, for the following improvements: Erecting a 1-story stone cottage, 24 x66 ft., constructing new metal cornice gutters and conductors for the main building, etc. W. L. Dow & Son, Sioux Falls, S. D., are the archts.

Savannah, Tenn.—The County Court has authorized the erection of a court house at a cost of $25,000, and has appointed a Bldg. Com. to have charge of the matter.

Gainesville, Tex.—Bids will be received Apr. 20 by Mayor J. T. Leonard for erecting a 3-story brick City Hall.

Ft. Sam Houston, Tex.—Bids will received by L. J. Fleming, Q. M., U. S. A., on May 15, for constructing certain buildings at this post, as advertised in The Engineering Record.

Ft. Columbia, Wash.—Bids will be received Apr. 20, by Capt. Goodale, Q. M., U. S. A., Astoria, Ore., for constructing a fire apparatus building and wagon shed here.

Spokane, Wash.—The Deaconess Hospital Assoc., it is stated, has accepted the plans of Galbraith & Hals. for the new hospital bulidings which are to be erected at a cost of $75,000. The buildings will consist of an administration building, 3 stories high, 40x00 ft., and 2 wings each 2 stories high, 28x100 ft. All 3 buildings are to be of brick and stone.

Berkeley Springs, W. Va.—The Morgan County Court, it is reported, has appointed a committee to consider the advisability of remodeling the old or erecting a new court house. The Com. is reported to be in favor of erecting a new building.

Mauston, Wis.—It is reported that an armory is to be erected for Co. D, at a cost of about $15,000.

Nanaimo, B. C.—Bids will be received Apr. 22 by Fred. Gelinas, Secy., Dept. Pub. Wks., Ottawa, for installing a heating system in the Post Office here.

Toronto, Ont.—The proposal of the Medical Health Officer to erect a hospital for the treatment of measles and chickenpox has been approved by the Local Bd. of Health. The cost of the building is to be about $30,000.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

**Birmingham, Ala.*—The Jefferson Constr. Co., it is stated, has received the contract to erect the Masonic Temple, at $33,726.

Los Angeles, Cal.—The Development & Bldg. Co., it is stated, has secured a permit to erect a 7-story brick and steel office building at 6th and Spring Sts., at a cost of $170,000.

Denver, Colo.—The F. E. Edbrooke Architect Co., 510 Opera House Blk., it is reported, will soon ask bids for erecting the 8-story building at 17th and Champa Sts.

Lewis Price, it is stated, is negotiating for a site at 19th St. and Bway., on which it is proposed erecting a 4-story store and apartment building, to cost about $40,000.

Washington McClintock, it is reported, is contemplating the erection of either a 6 or an 8 story store and office building on California St., to cost $150,000.

Bridgeport, Conn.—A. C. & W. B. Wheeler, it is stated, are contemplating the erection of a 4-story business building on Main St., to cost $40,000.

Washington, Ga.—It is stated that a $15,000 auditorium is to be erected on the grounds of the St. Joseph Academy.

Augusta, Ga.—The Masons of Augusta will erect a temple on Broad and 7th Sts. F. M. Philpot, Chmn. Bldg. Com.

Augusta, Ga.—The Augusta Ry. & Electric Co. (H. V. Schreiber, Ch. Engr., 803 Broad St.) it is stated, intends erecting a freight and passenger station and office building at Randolph St., at a cost of $35,000.

Wallace, Idaho.—It is reported that the Elks are preparing to erect a $16,000 lodge building. John Wourms, Secy.

Streator, Ill.—The Masonic Lodge will erect a $16,000 temple. Plans will be ready about May 1st.

Springfield, Ill.—It is reported that improvements are to be made to the St. Nicholas, at a cost of $100,000.

Rockford, Ill.—W. H. Cook, 401 S. Court St., it is stated, submitted the lowest bid for erecting the Y. W. C. A. Bldg., on S. Madison St., at $18,466.

Moline, Ill.—It is reported that plans have been completed for a $20,000 building, which is to be erected by the Central Union Telephone Co.

Terre Haute, Ind.—A 5-story theatre is to be erected here and is to be leased to L. W. Barhydt and Jack Hoeffler, prop. of the Hoeffler Repertoire Co.

Columbus, Ind.—It is reported that bids are wanted Apr. 24 for erecting a Pythian Hall.

Des Moines, Ia.—The National Home of the United Commercial Travelers, it is stated, is to be erected in this city, at a cost of $200,000.

Benson & Marxer, 425 Grand Ave., it is reported, have received the contract to erect a 4-story building, at 12th St. and Grand Ave., for Chas. W. Rogg, to cost $20,000.

Cedar Rapids, Ia.—Bartlett & Kling, of Cedar Rapids, have secured the contract for the inside finish of 3d Avenue Hotel. The work includes about 30,000 yd. plain plastering and some ornamental work; 20,000 ft. Terrazzo floors with Terrazzo cove base; 65,000 ft. finished cement floors, with cove base; 7,500 sq. ft. marble finish; 1,000 ft. of concrete sidewalk light work; 1,000 birch, veneered doors and other interior mill work, art glass, electric wiring and telephone system, painting, etc.

Kansas City, Kan.—Geo. A. Grund, it is stated, has left to this city $100,000 with which to erect a hotel. Henry McGrew is one of the executors of the estate, and may be able to give further information.

Ft. Scott, Kan.—The erection of a Y. M. C. A. building at a cost of $20,000 is reported under consideration.

**Hopkinsville, Ky.*—The Forbes Mfg. Co., of Hopkinsville, it is stated, has secured the contract to erect an $18,000 freight depot here on 9th St., for the Louisville & Nashville R. R. Co.

New Orleans, La.—The Young Men's Gymnastic Club, it is stated, is contemplating the erection of a 6-story clubhouse at an estimated cost of $125,000.

Baltimore, Md.—Local press reports state that the Baltimore & Ohio R. R. officials have requested bids to be submitted by Apr. 25 for erecting the general office building at Baltimore and Charles Sts., which is to be a fireproof structure. Parker & Thomas, 612 N. Calvert St., are the archts.

The Hughes Furniture Mfg. Co. will erect a 3-story building 50x90-ft. on Haubert St. for the storage of furniture.

North Andover, Mass.—The Brightwood Mfg. Co. is to erect a 1-story and basement brick building, 172x58 ft.

**Items marked thus give the names of parties awarded contracts.*

St. Paul, Minn.—C. E. Dickerman will erect a 1-story building to be used as a theatre on Minnesota and 6th Sts., to cost $35,000.

**Red Wing, Minn.*—The following are reported to be the bids received for erecting the Odd Fellows Building, on 3d St.: Johnson & Nelson, Red Wing, $24,000; Elliot Bros., Minneapolis, $21,800; J. B. Nelson, Mankato, $20,070; W. J. Longcor, Red Wing, $19,900 (awarded contract).

St. Louis, Mo.—It is stated that the Carleton Bldg. has been sold to a company composed of Jas. W. Black, and others, who intend erecting a 4-story addition to the structure, and making other improvements at a total cost of about $100,000.

Farrar & Tate, Wainwright Bldg., are said to be interested in the erection of a 15-story building, at 14th St. and Washington Ave., to be used for commercial purposes, and estimated to cost about $1,000,000.

Omaha, Neb.—The Cudahy Packing Co., it is reported, is contemplating the erection of a 3-story and basement wholesale and retail meat depot, to cost about $40,000.

Newark, N. J.—The Order of Elks, it is stated, is considering the erection of a 4-story building at a cost of $50,000.

**New York, N. Y.*—The contract for the iron, steel and ornamental iron work for the 6-story stable to be erected at 166-170 Perry St., for Edmund Coffin (Hill & Stout, Archts.) has been awarded to S. Fischer Miller, 1133 Bway. Mr. Miller is in the market to purchase the beams and lintels and the ornamental iron work, consisting of iron saddles, wheel guards, shutter eyes, rolling steel doors, wrought-iron stairs, wrought-iron chute, trap doors, flag-pole bracking, gratings, patent light work, etc., etc.

Brooklyn, N. Y.—The Belle Harbor Yacht Club, it is stated, will erect a new clubhouse, to cost $15,000.

Syracuse, N. Y.—Archimedes Russell, 321 The Bastable, it is stated, has completed plans for a 6-story business building, which is to be erected at S. Franklin and W. Water Sts., at a cost of about $50,000.

Rochester, N. Y.—It is stated that plans are to be prepared for a new building for the German Home for the Aged, which is to be erected near the one now in use on South Ave. The cost is to be about $40,000.

Lockport, N. Y.—The Directors of the Farmers & Mechanics' Bank, it is stated, have selected the Lincoln Block site, and intend erecting a 6-story building to cost $100,000.

Buffalo, N. Y.—The following are reported to be the bids received, Apr. 4, for the masonry, cut stone and iron work on the building to be erected by the Wilson estate at Main and Tupper Sts.: Niederpruem-Gibbs Co., $21,498; J. H. Tilden, $22,833; John Lannen, $22,880; Henry Schaefer's Sons, $22,921; Chas. Berrick's Sons, $22,934; C. A. Rupp Co., $23,479; B. I. Crooker, $24,088; E. C. Rumrill, $24,209; Geo. Schaf, $26,548; Geo. Kempf Sons Co., $27,572.

It is reported that the following are the bids received for erecting a 1-story addition to the Manufacturers & Traders' Bank: Henry Schaefer's Sons, $38,891; B. I. Crooker, $41,750; J. H. Tilden Co., $41,372.

Spencer, N. C.—It is stated that it is proposed to erect a Y. M. C. A. building here to cost about $20,000.

Akron, O.—Howard Shaw, of Chicago, Ill., it is reported, has prepared plans for a $40,000 clubhouse, which is to be erected by the Portage County Club.

Portsmouth, O.—The officials of the Norfolk & Western R. R., it is stated, have offered $15,000 toward the erection of a Y. M. C. A. bldg. here.

Dayton, O.—Peters, Burns & Pretzinger, Kuhns Bldg., it is stated, are preparing plans for a Y. M. C. A. building to be erected here.

Cincinnati, O.—W. H. Ellis, it is stated, has prepared plans for a 7-story concrete building, which is to be erected by the Wilbur H. Murray Mfg. Co. on 5th St., at a cost of about $70,000.

Oklahoma City, Okla. Ter.—It is reported that the Frisco (J. F. Hinckley, Ch. Engr., St. Louis, Mo.) and Rock Island Railroads (W. L. Darling, Ch. Engr., Chicago, Ill.), intend erecting a union depot here, to cost about $125,000.

**Philadelphia, Pa.*—Cramp & Co., 1421 Filbert St., it is stated, have secured the contract to erect the 10-story fireproof office building for the U. S. Fidelity & Guaranty Co., at German and Calvert Sts., at a cost of about $200,000.

Allegheny, Pa.—It is stated that as soon as the Mayor signes the ordinance granting to the Pennsylvania R. R. Co. the site on Federal St. for a passenger station, work on the structure will be commenced. The building is to cost about $250,000. Price & McLanahan, of Philadelphia, are the archts.

Pittsburg, Pa.—The Currier Co., it is stated, is representing a company which proposes erecting a 19-story market and office building on the site of the present market houses.

Kittanning, Pa.—Bids will be received until Apr. 20 by the Kittanning Brewing Co., for erecting a building. Address H. G. Luker, Kittannning.

Deadwood, S. D.—Plans are being prepared, according to reports, for a $60,000 opera house, which it is proposed erecting this season. Bernard Mullen may be able to give further information.

Houston, Tex.—Capt. John Finnegan, it is stated, is having plans prepared by Sanguinet & Staats, of Dallas, for a 6-story hotel which he contemplates erecting.

Bids will be received Apr. 18 by H. Waddell, owner, for erecting 3 additional stories and making alterations to the present building, cor. Fannin St. and Prairie Ave. Cooke & Co., Archts., 63 Theater Bldg.

Dallas, Tex.—A building permit has been granted to C. B. Gardner, Pres. of the Order of Praetorians, to erect a 14-story building of steel, brick and terra cotta, at Main and Stone Sts., at a cost of $150,000, according to plans prepared by Keyser-Mozier Co., Juniata Bldg.

Corsicana, Tex.—The 2-story main building of the Odd Fellows' Widows and Orphans' Home, it is reported, has been destroyed by fire.

Anderson, Tex.—Bids are wanted Apr. 24 for erecting a 3-story brick building, 30x70-ft. Address J. H. Kennard, Anderson, Tex.

Norfolk, Va.—It is stated that the National Realty Co. (Henry C. Hoffheimer, Pres.), is considering the erection of either 5 or 6 story store and business building on Granby and Randolph Sts. and City Hall Ave., to cost about $100,000.

Richmond, Va.—Frank W. Brown, Vice-Pres. & Treas. Gordon Metal Co., writes that it is proposed to erect a new warehouse, to cost about $30,000.

Seattle, Wash.—See "Miscellaneous."

Milwaukee, Wis.—Plans have been submitted to the Bldg. Inspector, for a 3-story brick factory, 50x150 ft., which is to be erected by the Northwestern Lithographing Co. at 15th and Clybourn Sts., at a cost of $30,000.

Walkerville, Ont.—Walker & Son, it is reported, contemplates erecting a distillery at a cost of about $300,000.

Montreal, Que.—The La Patrie Publishing Co., it is stated, intends erecting a building to cost $60,000.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Bessemer, Ala.—The congregation of the First Presbyterian Church, it is stated, is contemplating the erection of a new edifice to cost about $15,000.

New Britain, Conn.—Herbert C. Ide writes that a new church is to be erected in the eastern part of city, and he has charge of the matter.

Denver, Colo.—Kittredge & Graham, Exchange Bldg., owners and architects, have completed plans for apartment house to cost $30,000; steam heat, hardwood finish, pressed brick, terra cotta and stone.

Rev. Frederick Bender intends erecting a R. C. Church, at 20th and Curtis Sts., at a cost of $100,000.

Washington, D. C.—Hunter & Bell, 1010 F St., N. W., it is reported, are preparing plans for a 4-story and basement apartment house, which is to be erected at California Ave. and 18th St., by John L. Warren. Probable total cost $50,000.

Delevan, Ill.—It is reported that bids will be received until Apr. 18 for erecting an edifice for the R. C. Church of the Immaculate Conception. Rev. C. L. M. Rimmels, Pastor.

Sioux City, Ia.—It is reported that the congregation of the First Presbyterian Church is contemplating the erection of a new edifice at a cost of $50,000.

**Emmetsburg, Ia.*—P. R. Wells, of Emmetsburg, it is reported, has received the contract to erect the R. C. Church, at a cost of $25,000.

Lexington, Ky.—The Bd. of Trus. of the Baptist Church, it is reported, has accepted plans for a new edifice which is to cost $40,000. Address pastor.

Wareham, Mass.—It is reported that the members of the Wareham Congregational Church intend erecting a new edifice at a cost of $13,000. Geo. P. Baller, Chmn. Bldg. Com.

Stockbridge, Mass.—Sam'l W. Woodward, of Washington, it is stated, has had plans prepared for a residence which is to be erected on Field Hill at a cost of $150,000.

Holyoke, Mass.—A. D. Durochers is said to be having plans prepared by G. P. B. Alderman & Co., of Holyoke, for a 4-story tenement which is to be erected at Sargeant and Maple Sts., at a cost of $35,000.

Minneapolis, Minn.—Fritz Schreyer, it is stated, intends erecting an apartment house at 5th St. and 7th Ave., to cost about $30,000.

A $40,000 residence, it is stated, is to be erected on Mt. Curve Ave. for Mrs. Lester Brooks.

Chas. W. Weeks, it is stated, has had plans prepared for a $15,000 flat which is to be erected in Southeast Minneapolis.

St. Paul, Minn.—A permit has been issued for two 3-story brick flats, to be erected on Virginia Ave., bet. Dayton and Nelson Aves. M. J. O'Neil, owner. Cost, $18,000 each.

Rushford, Minn.—It is reported that a Lutheran Church is to be erected at a cost of $20,000.

Aitkin, Minn.—The congregation of the St. James R. C. Church, it is reported, is contemplating the erection of a new edifice to cost $15,000. Rev. Jos. Wurm, pastor.

McComb, Miss.—It is reported that bids will be received until May 1 for erecting the Centenary Methodist Church. D. M. Holmes, Secy. Bldg. Com.

Hickory, N. C.—It is reported that Bauman Bros, of Huntsville, Tenn., have prepared plans for a new edifice which is to be erected by the members of the Presbyterian Church at a cost of $30,000. Edw. B. Cline, Chmn. Bldg. Com.

Lancaster, O.—Richards, McCarthy & Bulford, of Columbus, it is stated, have prepared plans for a new edifice which is to be erected for the First M. E. Church at an approximate cost of $75,000.

Steubenville, O.—Bids will be received Apr. 29 by St. Peters Church Com., for erecting the new St. Peter's Church.

Cincinnati, O.—Edw. Schlochtermeyer, Hopkins and Linn Sts., it is stated, is preparing plans for a $27,000 flat which is to be erected by Mrs. E. Bramage, at Mt. Hope Road, Price Hill.

Oklahoma Okla. Ter.—It is stated that the congregation of the First Baptist Church has authorized plans prepared for a new edifice which is to be erected at once at a cost of $65,000.

**Philadelphia, Pa.*—The American Structural Steel Co., of Carnegie, it is stated, has received the contract for the steel work and fireproofing of the 18-story apartment house which is to be erected by John Stafford at 16th and Walnut Sts. This portion of the work, it is stated, is to cost $250,000.

Houston, Tex.—Plans and specifications will be received until June 15 by Abe M. Levy, Chmn. Bldg. Com., for a synagogue to be erected at Rusk Ave. and Jackson St., for the Beth Israel congregation, the cost to be about $40,000.

Norfolk, Va.—The Raleigh Realty Corporation Co., it is stated, is about to erect a block of houses, aggregating a cost of about $60,000.

Seattle, Wash.—H. Ryan & Co., Globe Bldg., it is stated, are the archts. for the 7-story apartment house which is to be erected at 7th Ave. and Pike St. at a cost of about $200,000. The Waldorf Bldg. Co. is reported interested in the project.

**Campbellsport, Wis.*—It is reported that Geo. Boll, of Manitowoc, has secured the contract to erect an edifice for the St. Matthew Church congregation at a cost of $28,000. Rev. B. Jardy, pastor.

Milwaukee, Wis.—Local press reports state that bids are soon to be asked for erecting an edifice for the congregation of the German Evangelical Friedens Gemeinde Church, at 13th and Locust Sts., which is to cost about $25,000. Dohmen & Jacobi, of Milwaukee, are the archts.

The Lake Front Realty Co., it is reported, intends erecting three 4-story brick and stone apartment houses at Lake Drive and Gilman St., to cost about $50,000 each.

SCHOOLS.

Notes Arranged Alphabetically by States.

Palo Alto, Cal.—The Bd. of Educ. has purchased a site and intends erecting a high school. The erection of a 10-room grammar school is also reported under consideration.

Los Angeles, Cal.—The citizens on Mar. 21 voted to issue $520,000 bonds for the construction and equipment of new grammar schools and $260,000 for the purchase of additional land and erecting another high school and for the equipment of the Polytechnic High School. Jas. A. Foshay, Supt. City Schools.

Derby, Conn.—A bill has passed the House authorizing this city to issue $25,000 bonds to erect a school.

Washington, D. C.—Bldg. Inspector Snowden Ashford is considering plans for a heating, lighting and water supply plant for the proposed new Industrial Home School for colored children which is to be erected in Blue Plains.

*Burgess & Parsons, Washington, have secured the contract for erecting the H. T. Blow School (bids opened Mar. 25) for $42,693.

Arcadia, Fla.—See "Water."

Coeur d'Alene, Idaho.—The St. Teresa Academy Trus., it is reported, intend erecting a $20,000 school. Address Sister M. Amatus.

Pocatello, Idaho.—It is stated that bids are wanted Apr. 25 for erecting a wing to main building at Academy of Idaho; also for other buildings. Jas. F. Kane, Pres. Bd. Trus.

Chicago, Ill.—Wm. J. Brinkmann, 163 Randolph St., is preparing plans for a parochial building to be built at Garfield Blvd. and Honore St. for St. Basil's R. C. congregation. It will be a three-story structure of brick and stone. The cost of construction is estimated at $50,000.

**Muncie, Ind.*—Chas. E. Lambert, School Trus., writes that the contract for erecting Whitely School (bids opened Apr. 3) has been awarded to Morrow & Morrow, of Muncie, for $17,841. W. H. Johnson & Son Co., of Indianapolis, secured the contract for ventilating and heating same for $2,475.

Indianapolis, Ind.—It is reported that about Apr. 17 the Trus. of the Indiana Industrial School for Girls will ask bids for erecting the new buildings for the Inst. which are to consist of 7 two-story cottages, a school house, a power house, a horse barn and a dairy. Plans have been prepared by Clarence Martindale, Indiana Trust Bldg., for the structures.

It is reported that bids will be received until Apr. 25 for installing a ventilating and heating plant in school at Rural and Indiana Sts. John E. Cleland, School Director.

Mishawaka, Ind.—It is reported that the School Bd. is arranging to erect a $25,000 school to replace the structure which was recently destroyed by fire.

Bloomington, Ind.—W. H. Smith, Accountant, Univ. of Indiana, writes that no architect has been selected as yet for the law school and library to be erected at the college, at a cost of $100,000.

Fairfield, Ia.—An 8-room school is to be erected according to reports at a cost of $20,000.

**Goldfield, Ia.*—Otto Nitge, of Mankato, Minn., it is stated, has received the contract to erect the school at $15,000.

Des Moines, Ia.—It is stated that bids are soon to be asked for erecting the North Des Moines school, and that bids are r ceived for the purchase of $25,0 this purpose.

Cresco, Ia.—It is stated that received until Apr. 28 for erec school. C. I. White, Secy. School

Lawrence, Kan.—It is reported wanted Apr. 21 for erecting a at the Univ. of Kansas. Willis K. Bd. Trus.

Covington, Ky.—The Clk. Bd. of that it is proposed to erect a scho cost of $75,000. Archts., Schofiel

**Louisville, Ky.*—Jos. McWillian Louisville, it is stated, have recei tract to install a heating plant in School Hill Dist. at $9,240, and & Co., the contract for the heating Sylvia Ave. School at $5,014.

Baltimore, Md.—The plans of Pe of N. Y. City, have been accepted Com. for the new Maryland Inst., erected at Mt. Royal Ave. and La is to be constructed of either gr or Indiana limestone, and is to be

Dorchester, Mass.—Bids will be 17 by the Schoolhouse Comrs., Clipston Sturgis, Chmn.) for erecti school on Howard Ave., Dorcheste McGinty, Archt., 101 Tremont St.,

Rockport, Mass.—It is reported th Bd. has decided to erect a $19,00

North Andover, Mass.—See "W

Williamstown, Mass.—The erectio mitory at Williams College is rep consideration.

Sault Ste. Marie, Mich.—It is r the Algonquin School has been fire.

Ann Arbor, Mich.—Jas. H. Wad of Regents, Univ. of Michigan, wr contract for erecting an adition to Laboratory at the Univ., bids for to have been opened Apr. 10, has awarded, and will not be before Ap

Belle Plaine, Minn.—It is report citizens have voted in favor of issui erect a high school.

**Ely, Minn.*—Smith & Vokes, of is stated, have received the contract new school at $41,475.

St. Paul, Minn.—J. A. MacLeo mitted plans to the School Bd. for th School, which is to be erected on and is to consist of 8 rooms and $35,000.

Aberdeen, Miss.—An amendment ter of Aberdeen has been filed wit of State, authorizing an issue of $ to be used to purchase a site and public school.

**Columbia, Mo.*—The contract to gymnasium at the Univ. of Miss stated, has been awarded to R. Wi Louis, at $41,600.

Monett, Mo.—The citizens on A in favor of erecting a high school bonds to the amount of $25,000 fo pose.

Vandalia, Mo.—At the school el Apr. 4 the citizens voted in favor $20,000 bonds to erect a school.

Dillon, Mont.—Archt. C. S. Hai ena, writes that bids will be received 20 for erecting a normal school at D able cost, $60,000.

Fairfield, Neb.—The proposition to 000 bonds to erect a school is report carried at the election held Apr. 1.

Ocean City, N. J.—The erection school at a cost of about $40,000 is der consideration.

Collingswood, N. J.—It is stated t of Educ. has rejected all bids receive ing the 2 schools and will readvertise submitted exceeded the amount avail is $42,400.

Newark, N. J.—Bids will be rec Apr. 21 by the Bd. of Educ. (R. Secy.), for making repairs to vari buildings, work to include carpent plumbing, steam fitting and electrical tificial stone and asphalt paving, fla

Paterson, N. J.—Press reports stat are wanted Apr. 17 for $275,000 Hi bonds.

New York, N. Y.—Bids will be rec 24 by the Bldg. Com., Bd. of Tru Shepard, Chmn.) for ventilating an work for the buildings of the Colle City of New York, to be erected on olas Terrace and 140th St.

*The following are the bids opene 10 by C. B. J. Snyder, Supt. Scho for sanitary work and gas fitting of school 64, Manhattan Boro.: Frank J. 898; Christ. Nally Co., 2398 B'way, $1 tract awarded); Jere. J. Deady, $23, C. Ormond, $18,780; Rossman & Br $19,300, and Jas. Harley, $20,410.

Bids will be received until Apr. Com. on Bldgs. of the Bd. of Tru Shepard, Chmn.) for plumbing wor buildings for the College of the City York at St. Nicholas Terrace and 140

Bids will be received Apr. 24 by Snyder, Supt. School Bldgs., for th construction, etc., of new School No. mated cost, $230,000, and for the outside iron stairs at School No. 11 forming classrooms in gymnasium of 20, all in Manhattan Boro.

President Butler, of Columbia Un reported, has announced that 2 new are to be erected at the Univ., one

**Items marked thus give the names of parties awarded contracts.*

ther a law department building. ire to be of stone and brick. received until May 1 by C. B. J. of School Bldgs., for making repairs, etc., to schools Nos. 57, 72, 77, 78, 83, 86, 96, 103, 58, 159, 168, 171 and 172, all in o.

Y.—Bids will be received Apr. J. Snyder, Supt. School Bldgs., r installing ventilating and heat- n the Commercial High School; on stairways, alterations, repairs, Nos. 18, 24, 25, 33, 36, 45 and klyn Boro.

Y.—The citizens have voted in rging the school at a cost of

.—E. L. Williams, Treas. Cornell that the lowest bid opened on nstructing the N. Y. State Col- lture at Cornell Univ., was sub- rris Kantrowitz, of Albany, for ny and Dairy Bldg., $177,700; Pavilion, $12,900 and two re- $7,300.

N. C.—$50,000 has been received Carnegie toward the erection of a Univ. of North Carolina.

gift of $24,000 has been received Carnegie toward the erection of lding at Baldwin Univ.

25,000 has been given to Heidel- Andrew Carnegie, a similar sum or maintenance.

Miami Univ. has received $40,000 Carnegie to erect a library on a like sum is raised for the main- building.

O.—Andrew Carnegie has given Otterbein Univ. for a library, on a like sum is raised.

—The Trus. of the Denison Univ., have decided to erect a young y at the Shepardson College, to furnishing, $35,000 and to re- ney Science Hall which was re- d by fire.

—The citizens have voted in favor ,000 bonds for new schools.

O.—It is reported that bids will ntil Apr. 25 by the Bd. Educ. er, Clk.), for erecting 2 brick). Dist. Nos. 7 and 9, in Ridge a school in Sub. Dist. No. 1, ship.

O.—Bids will be received until e Bd. Educ. (Andrew Forsythe, 00 school bonds. d that bids are wanted for erect- to the Lincoln School.

.—A building permit has been 3-story brick parochial school erectel for St. Francis' parish at 00.

It is stated that Andrew Car- n $40,000 to Buchtel College to hall.

O.—Bids will be received May 1 nan, Clk., Bd. of Educ., for $100,- ds.

.—Bids will be received Apr. 24 on Bldgs., Bd. of Educ., (C. E.) for furnishing material and llows Ave. school. David Riebel, Bldg.

.—Bids will be received Apr. 20 y, Clk. Bd. of Educ., Blue Creek erecting a concrete block school No. 2.

a.—Edw. Stotz, Monon Natl. Bank pared plans for an addition to the School to cost $80,000 and Mc- ler, Bank for Savings Bldg., plans to the Latrobe School, which is to

School Com. of the Central Bd. s stated, has awarded the contract alterations to the Central High & S. Wilson, 543 3d Ave., at

.—P. J. Hurley, it is stated, has a contract by Ballinger & Perrot, S. 12th St., Philadelphia, to erect ne and brick parochial school for gregation at a cost of $50,000.

ter, Pa.—Bids will probably be about 5 weeks for the erection of in West Chester, to cost about hts., Seymour Davis and Paul A. 7 Walnut St., Philadelphia.

Pa.—The Shamokin Lumber & s reported, has received the con- the Grant and Stevens Schools Apr. 3) at a total cost of $72,114.

Pa.—Andrew Carnegie has given legheny College on condition that raised. It is the purpose of the t a preparatory school building, a mnasium building, an addition to and improvements to the Reuter Halls.

Pa.—The School Bd. of West s decided to erect an 8-room school to cost about $20,000.

ty, Pa.—Bids will be received un- by the Bd. of Educ. (Chas. J.) for erecting a 4-room brick ad- ol. Louis O. Brosie, Archt., 407 , Pittsburg.

S. C.—Grandy & Sons, of Green- ported, have received the contract graded school here at $10,000.

D.—It is reported bids are wanted erecting a brick school. B. A. School Bd.,

Nashville, Tenn.—A new school will be erected in the 14th Ward, to cost $14,000.

A bill has passed the House authorizing the issue of $300,000 bonds for the erection of a high school.

Superior, Wis.—Carl Wirth, Bank of Commerce Bldg., it is stated, has completed plans for the Allouez School. Probable cost $20,000.

Milwaukee, Wis.—Buemming & Dick, 1107 Pabst Bldg., it is stated, have completed plans for a $125,000 school to be erected at 12th and Center Sts. It is to be of brick and stone, 3 stories high.

Milwaukee, Wis.—See "Power Plants, Gas and Electricity."

Madison, Wis.—Bids will be received May 2 by the Bd. of Educ. (O. S. Norsman, Clk.) for the general construction and mechanical equipment of the new High School. A deposit of $100 required on plans and specification. Cass Gilbert, Archt., 79 Wall St., New York, N. Y.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Washington, D. C.—Bids will be received until Apr. 28 by the Comrs. D. C. (Henry B. F. MacFarland, Chmn.) for the collection and disposal of ashes, garbage, dead animals, night soil and miscellaneous refuse for a period not extending beyond June 30, 1910, and commencing for ashes, miscellaneous refuse and night soil on Aug. 1, 1905, and for garbage and dead animals on Dec. 1, 1905.

**Asbury Park, N. J.*—Arthur Redfern and Fritz Koonemenol, of Secaucus, L. I., N. Y., are stated to have secured the contract for the removal of garbage, rubbish, and ashes within the city limits for a period of 3 yrs. (bids opened Apr. 3), for $13,500.

Brooklyn, N. Y.—Bids will be received until Apr. 25, by John McG. Woodbury, Comr. of Street Cleaning, N. Y. City, for furnishing and delivering 10 watering or sprinkling trucks in the Boro. of Brooklyn.

Syracuse, N. Y.—Bids will be received Apr. 17 by the Bd. Contract and Supply, for sprinkling about 360,000 ft. of streets and flushing about 161,000 ft. with flushing machines.

Akron, O.—Bids will be received Apr. 28 the Bd. Pub. Service (Chas. H. Waters, Secy.), for sweeping and sprinkling portions of numerous streets.

Rome, N. Y.—The lowest bid opened on Apr. 3 by the Bd. of Public Wks. for cleaning the paved streets, etc., for a period of 3 years, is stated to have been submitted by Chas. H. Connor, for $31,477, and for 5 years, $50,984. All bids are stated to have been rejected and new bids will be received Apr. 20.

**South Bethlehem, Pa.*—Thos. Ganey, Boro. Secy., writes that the contract for the collection, removal and disposal of garbage for a period of 2 years /bids opened Apr. 3) has been period of 2 years (bids opened Apr. 3) has been hem, for a total of $6,978, for the 2 years from May 5, 1905.

NEW INDUSTRIAL PLANTS.

See also Business Buildings.

F. W. Bird & Son, East Walpole, Mass., are having plans prepared for a plant for making roofings at Hamilton, Ont. The plant will include a 50x280-ft. mill and a 40x100-ft. warehouse; 100 h. p. will be developed.

The Weir Stove Co., Taunton, Mass., is erecting two wooden buildings, one to replace a building recently torn down and the other an addition to the foundry. These buildings will increase the company's production about 15 per cent.

C. F. Huber, Gen. Supt., Lehigh & Wilkesbarre Coal Co., Wilkesbarre, Pa., writes that it is the company's intention to rebuild Sugar Notch No. 9 breaker, recently burned, on approximately the same site as that occupied by the old structure. The capacity of the new breaker will be about 1,500 tons daily.

The Oklahoma Oil, Paint & Asphalt Co., Oklahoma City, Okla. T., has been organized for the purpose of mining asphalt and refining and manufacturing asphalt paints. The company is now mining 100 tons daily, and is in the market for a 20-ton refining machine, crusher and dump cars, and will be in the market for paint machinery this summer.

The Walker Mfg. Co., Council Bluffs, Ia., which makes farm implements and woven wire fence, writes that the main building of its plant was completely destroyed by fire, but that one wing was not burned, and work is being carried on in that part of the plant. Plans for rebuilding have not yet been settled.

The Passumpsic, Vt., Fiber Leather Co. writes that it is clearing away the debris of its fire of last December and starting work on a new mill, which will consist of a 2-story reinforced concrete building 60 ft. square, a 60x50 ft. concrete dry house and a 30x100 ft. storehouse. The boiler house, containing two 90-h. p. boilers used for drying, was saved. The mill will be run by a pair of twin 350-h. p. horizontal turbines and a 100-h. p. turbine. I. W. Jones, Milton, N. H., archt.

T. R. James & Son, Fort Worth, Tex., write that they will probably build within the next two months a 2-story, 100x250-ft. harness factory of brick or stone and install a 50-h. p. engine and two 50-h. p. boilers.

The Crescent Mfg. Co., Greenfield, O., is receiving figures on the construction of a 120x373-ft. brick building to be erected in Louisville, Ky., and used as a wood and iron-working novelty plant. Arrangements for power plant are about completed, but other machinery and castings have not yet been bought. A. E. Shaner, Mgr.

H. E. Ferree, 313 Hill St., Hannibal, Mo., writes that he, with others, intends to build one or more pig iron manufacturing furnaces with a total daily capacity of 400 tons in Alabama and a plant in Virginia to have a daily capacity of not less than 200 tons. He desires to correspond with engineers and practical furnace operators regarding such plants.

J. J. Harby, Sumter, S. C., is considering the erection of a canning factory.

The Stone Building Supply Co., Greensboro, N. C., will erect a 40x100-ft. building to have a daily capacity of 30 tons wood fibre. The company is in the market for shafting, belting and power plant.

The Robinson Kraut Co., Green Spring, O., will erect a 2-story, 72x120-ft. building, to have 24 tanks of 140 bbls. capacity each. A 20-h. p. engine will be used.

Cash & Allen, Eagle Rock, Va., are erecting a 5-story, 36x74-ft. flour mill, to have a capacity of 60 bbls.

The Rose Fire Brick Co., 604 Merchants' Exchange, San Francisco, Cal., is erecting a plant at East Oakland, Cal., which will include three 140x60-ft. buildings, a large building containing 400 h. p. boilers and engines. Electric motive power will be used. The company has 5 acres of land on deep water front with railroad facilities, and will be prepared to ship by ocean steamer to eastern points. The company expects to be manufacturing in 4 months.

The Farlow Draft Gear Co. is arranging to erect a plant and foundry in or near Baltimore for casting its patent car-coupling gear, according to newspaper reports.

The Eagle Brewery Co., Columbus, O., has been incorporated, with a capital of $500,000, by Henry T. Linke, E. F. Arras, John Catlon, Frank Peirano and E. N. Huggins, according to local newspaper reports. It is stated that the company intends to erect a brewery to have an annual capacity of not less than 150,000 bbls.

The Carrison Veneer & Woodwork Co., Columbus, Ga., will erect a new plant, including a 2-story building 125 to 150 ft. long and outbuildings for boiler, engine, etc., according to local press reports.

The Pocomoke Guano Co., Norfolk, Va., is completing improvements to its property which will probably cost $100,000, according to local press reports. The improvements are stated to include the erection of a factory building to have 800,000 sq. ft. floor space, a 200-ft. wharf, a system of steam traveling derricks, electric lighting plant and tenements for employees.

The Morley Twine & Machinery Co., Sioux City, Ia., will erect a plant to cost $100,000, during the coming summer, according to local press reports.

A building permit has been issued to the Froedert Bros. Grain & Malting Co., Milwaukee, Wis., for the erection of a grain-storage elevator estimated to cost $20,000.

The Endicott-Johnson Shoe Co., Endicott, N. Y., will erect a 200-ft. extension to its factory, which will be 5 stories high, according to newspaper reports.

The Pineule Medicine Co., Chicago, Ill., has had plans prepared by Wm. Klewer for a 3-story, 52x141-ft. factory building to be erected on La Salle Ave., near Elm St., at a cost of $20,000, according to local press reports.

The Simmons Hardware Co., of St. Louis, will erect a new manufacturing plant in Sioux City, Ia. This plant will cost at least $300,000, and the contract on a cost plus fixed sum basis has been awarded to Frank B. Gilbreth, of New York and Boston, for its erection by the architects, Gorden, Tracey & Swartout, New York City. It has been practically decided to construct the interior of this building, columns, floors, etc., of reinforced concrete. Among other large work now on hand in Sioux City are the new shops for the Chicago & Northwestern R. R. and it is reported on good authority that two or three of the packing houses have decided to erect very large branches at Sioux City. It is somewhat notable as indicative of the wide-spread reputation which Mr. Gilbreth has achieved, that a St. Louis concern should come to New York for a builder because of his record for speed.

Negotiations are pending for the purchase of a thousand acres of mineral lands at Marion, Ky., by Louisville capitalists, in which event a concentrator and reduction works will be installed. Prof. J. F. Elsom, of New Albany, Ind., has been elected consulting chemist and assayer.

Otto Meinshausen, Pres., American Copper & Brass Works, Chicago, Ill., will erect a plant for the manufacture of complete equipments for breweries, distilleries and beet and cane sugar factories, according to local newspaper reports. It is stated that the cost of construction will be about $300,000.

Rush Culver, Marquette, Mich., has organized a company with a capital of $300,000 to erect a double-band sawmill, which will have a capacity of not less than 100,000 ft. every 11 hours, according to local press reports.

The Keewatin Flour Mills Co., Ltd., Ottawa, Can., has had plans prepared by the Allis-Chalmers Co. for a 5,000-bbl. flour mill and a 500,000-bu. elevator. The initial equipment of machinery will be for 3,000 bbl. capacity. Water power will be used. T. H. Sopher, formerly of Kansas City, Mo., has been appointed manager, and he will have charge of building the mills, machinery, etc.

John T. Eubanks, Concord, Tenn., expects to begin the manufacture of bricks on a small scale this season.

The Greendale Gas Engine Co., Worcester, Mass., will erect a 2-story building, 50 ft. square, and will use one of its 15-hp. engines for power.

The McInnis Canning Co., Hattiesburg, Miss., will erect a plant this fall or summer for canning syrup and vegetables and refining syrup.

David T. Blakey, 20 Twelfth St., Columbus, Ga., will erect a factory for the manufacture of wooden novelties. The approximate floor space required will be about 10,000 ft., and steam and electricity will be used for power.

The Pass Packing Co., Pass Christian, Miss., will erect a plant in Louisiana, but location has not yet been decided.

The International Hoisting Machine Mfg. Co., Minneapolis, Minn., will erect a 2-story 60x150-ft. concrete building, the 40-ft. main isle of which will contain a traveling crane. Contract has been let to John A. McLeod.

The Allis-Chalmers Co. will begin immediately a $3,000,000 extension to their Milwaukee works for the manufacture of electrical machinery of all kinds of the largest types, and for the construction of steam turbines, hydraulic turbines and gas engines. Three large buildings will be erected and two of the existing buildings extended. The electrical department at Milwaukee will be operated in connection with the plant of the Bullock Electric Mfg. Co., Cincinnati, which is owned by the Allis-Chalmers Co. These unique facilities will provide in the West what will undoubtedly be one of the largest engineering establishments in the world.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

Washington, D C.—Bids will be received May 16 at the Bureau Supplies and Accounts, Navy Dept., Washington, for furnishing at the Navy Yards, Mare Island, Cal.; and Puget Sound, Wash., a quantity of machine tools, etc., as follows: Schedule 154, dovetailing machine, punches, planing, milling and pipe expanding and flanging machines. Schedule 155, drill, press, crank shaper, lathe and drill chucks. H. T. B. Harris, Paymaster-Gen.

Chicago, Ill.—It is reported that bids will be received by the South Park Comrs. (E. G. Shumway, Secy.), until Apr. 19, for furnishing 2,000 bbls. Portland cement and 1,000 bbls. natural cement.

Havana, Ill.—Bids will be received until Apr. 21 by the Comrs. at Havana (M. B. Dunbar, Chmn., Green Valley), for excavating about 206,000 cu. yds. of dirt by dredge boat from the ditches of the Mason and Tazewell Special Drainage Dist. in the counties of Mason and Tazewell.

Portland, Me.—Bids will be received by Maj. W. M. Black, Corps. Engrs., U. S. A., on May 1, for cement, broken stone and sand, as advertised in The Engineering Record.

**Boston, Mass.*—The following are the bids opened on Apr. 3 by the Metropolitan Park Comn. (John R. Rablin, Engr.) for grading, surfacing and other work at Revere Beach Parkway, Main St. to Fellsway, Everett and Medford: Jas. Driscoll & Son, Brookline, $24,382; T. Stuart & Son Co., Newton, $20,353; The H. Gore Co., Boston, $20,178; Coleman Bros., Everett, $19,692; Jas. Doherty, Boston, $18,258, and T. H. Gill & Co., Boston, $17,407 (awarded contract). The detail bid of the successful bidder, T. H. Gill & Co., is as follows: 4,200 cu. yds. earth grading, 40 cts.; 200 cu. yds. filling material, 78 cts.; 300 lin. ft. 8 in. vit. pipe, 36 cts.; 1,200 lin. ft. 10 in. vit. pipe, 44 cts.; 1,200 lin. ft. 12 in. vit. pipe, 62 cts.; 700 lin. ft. 15 in. vit. pipe, 74 cts.; 5 cu. yds. stone mas'ry, $7; 39 concrete catch basins, $29; 1,940 sq. yds. concrete gutters, 70 cts.; 100 lin. ft. edgestone, $1.25; 5.400 cu. yds. loam surfacing, 24 cts.; 400 cu. yds. loam to be placed, $1.35; 13,800 sq. yds. broken stone surfacing, 44 cts.; 3,400 sq. yds. walk surfacing, 25 cts.; 1,000 sq. yds. tar roof felt waterproofing, 20 cts.; 1,500 sq. yds. wood block paving, 30 cts.; 10,100 lin. ft. 2-rail wooden fence, 16 cts.

Cambridge, Mass.—Bids will be received until Apr. 17 by the Water Bd. (Walter H. Harding, Clk.) for furnishing and delivering as ordered by the Water Dept., spruce lumber not exceding 9-in. in largest sections; Portland cement, screened, broken and gravel stone.

Cottage City, Mass.—The citizens are reported to have voted to appropriate $7,000 for the constr. of a sea wall. The work will probably be done by the day.

Breckenridge, Minn.—Bids will be received May 2 by the Bd. of Co. Drainage Comrs., for $50,000 Sub. Drainage Dist. No. 2 bonds. R. P. Glover, Co. Aud.

Bids are wanted May 2 for constructing drainage ditches in Sub-Drainage Dist. No. 2, requiring the removing of 429,678 cu. yds. of earth. John H. Ehlert, Chmn. Bd. of Superv., Sub-Drainage Dist. No. 2.

New York, N. Y.—Bids will be received by W. L. Marshall, Corps Engr., U. S. A., Army Bldg., on May 12 for the removal of rock in the North River, off Pier A, New York Harbor, as advertised in The Engineering Record.

Bids will be received Apr. 20 by the Comrs. of Parks (John J. Pallas, Pres.) for furnishing and delivering broken stone of trap rock and screenings of trap rock; 500 bbls. of Portland cement, and vitrified stoneware drain pipe for parks in the Boro. of Bronx. Separate bids will be received at the same time for furnishing and delivering 1,000 cu. yds. of trap rock screenings and 1,000 cu. yds. of loam or top soil on the Harlem River Driveway.

*The following are the bids opened on Apr. 12 by the Dept. Docks & Ferries, for furnishing material and extending and repairing pier at foot of W. 158th St. N. R.: W. H. Jenks, 129 Pearl St., $24,025; Bernard Rolf, 39 Cortlandt St., $21,405; G. B. Spearin, 17 Battery Pl., $21,180 (awarded contract), and Augustin Walsh, 96 Water St., $23,025.

Bids will be received Apr. 24, by Dept. Docks and Ferries (Maurice Featherson, Comr.), for furnishing and delivering about 3,000 cu. yds. sand and about 7,500 cu. yds. of broken stone.

**St. George, S. I., N. Y.*—The contract for building the St. George Ferry Terminals (bids opened Mar. 13), was awarded on Apr. 6, by the Dept. Docks & Ferries, N. Y. City, to the Seely-Taylor Co., 78 Broad St., for $366,200.

**Items marked thus give the names of parties awarded contracts.*

Buffalo, N. Y.—Bids will be received until May 13 by Lieut.-Col. H. M. Adams, Corps Engrs., U. S. A., for concrete superstructure on south pier, Buffalo, as advertised in The Engineering Record.

Utica, N. Y.—The Central New York Telephone Co. is reported to have decided to do considerable subway construction work this season, mostly under pavement of brick and asphalt.

Albany, N. Y.—Governor Higgins on Apr. 7 signed the bill reappropriating $10,000,000 for barge canal purposes.

Lorain, O.—Bids will be received Apr. 21 by S. I. Kimball, Gen. Supt. Treas. Dept., U. S. Life-Saving Service, Washington, D. C., for constructing a retaining bulkhead here.

Cleveland, O.—Press reports state that it is proposed to improve Cuyahoga River by dredging the river for 1½ miles, the cost to be about $1,500,000, of which the city will pay one-third and the property owners two-thirds.

Portland, Ore.—The State of Oregon has delivered to Maj. W. C. Langfitt, Corps Engr. U. S. A., Room 321, Custom House, a deed conveying title to the government of entire right of way for the Dalles-Celilo canal. This action removes the last obstacle to the construction of the canal, and insures the early beginning of work. This great undertaking is a canal and locks around an obstruction in Columbia River about 100 miles east of Portland.

Pittsburg, Pa.—Bids will be received until Apr. 22 by Maj. Wm. L. Siebert, Corps Engrs., U. S. A., Pittsburg, for dredging the approach to navigable pass, at Dam No. 2 Ohio River.

Newport, R. I.—Bids will be received by Col. J. N. Willard, Corps Engrs., U. S. A. Newport, on May 8, for dredging in Little Harbor, Woods Hole, Mass., as advertised in The Engineering Record.

The Com. on the Long Wharf is stated to have submitted its report to City Council recommending that a new road of granite blocks be laid on Long Wharf, with granolithic sidewalks on each side, the expense of the same being $28,000, with the statement that the N. Y., N. H. & Hartford R. R. would contribute $10,000, providing the city improve the wharf from Thames St. to Washington St., and maintain it as it would other streets in the city. A resolution was finally passed authorizing the committee to contract with the road as per its offer.

Providence, R. I.—Bids will be received by Lieut.-Col. J. H. Willard, Corps Engrs., U. S. A., Newport, on May 15 for dredging anchorage area in Providence Harbor, R. I., as advertised in The Engineering Record.

Seattle, Wash.—It is reported that plans have been prepared for a 4-story warehouse, a new dock 588 ft. in length, and the improvement of 2 slips at the location of the old Pacific Coast Co. gravity bunkers at foot of King St. These plans include the extension of Jackson St.; total cost of work about $300,000.

Guantanamo, Cuba.—Bids will be received May 6 by Mordecai T. Endicott, Ch. Bureau of Yards and Docks, Navy Dept., Washington, D. C., for two traveling cableways for the Naval Station at Guantanamo.

Panama.—Bids will be received by Maj. H. J. Gallagher, U. S. A., Purchasing Agent, Isthmian Canal Comn., Washington, D. C., May 10 for earth spreaders, unloading machines and unloading plows, as advertised in The Engineering Record.

Bids will be received by the Isthmian Canal Comn. at Washington, D. C., until May 12 for furnishing tinsmiths' supplies, carpenters' tools, nuts, rivets, bolts, etc., and for kitchen ranges and utensils, cooking stoves, stove pipe, etc.; until May 13 for corn brooms, feather dusters, etc., and for tumblers, drills, boring machines, wheel pressers, etc., and until May 15 for paints and oils, borax, bronze, glue, etc., and for sanitary fixtures and roughing material, galvanized pipe, wrought-iron pipe, etc., all 6 proposals advertised in The Engineering Record.

PROPOSALS OPEN

For Proposals see pages 60, 61c, 61d, 62, 63

WATER WORKS.

Bids Close.		See Eng. Record.
Apr. 15.	Pipe, etc., Oswego, N. Y. Adv. Apr. 8, 15.	Apr. 8
Apr. 17.	Pipe line, etc., Augusta, Me. Adv. Apr. 1 to 15.	Apr. 1
Apr. 17.	Pipe, Michigan City, Ind.	Apr. 8
Apr. 17.	Pump, etc., Phoenix, Ariz.	Apr. 15
Apr. 18.	Pumping engine, Toronto, Ont., Adv. Mar. 11, 18	Mar. 18
Apr. 18.	New Orleans, La. Adv. Feb. 11 to Apr. 15.	Feb. 11
Apr. 18.	Supplies, Wash., D. C.	Apr. 8
Apr. 20.	Pipe, etc., Millville, Minn.	Apr. 8
Apr. 20.	System, Hoisington, Kan.	Apr. 8
Apr. 20.	Main, Wilton, N. H.	Apr. 8
Apr. 20.	Lindsborg, Kan., Adv. Apr. 8.	Apr. 8
Apr. 24.	Whitebear Lake, Minn.	Apr. 15
Apr. 24.	Pumps, Cohoes, N. Y.	Apr. 15
Apr. 25.	Canal, pipe, etc., N. Orleans, La., Adv. Feb. 18 to Apr. 15,	Feb. 18
Apr. 25.	Well, Lower Brule, S. D.	Apr. 8
Apr. 25.	Pipe, etc., St. Louis, Mo.	Apr. 15
Apr. 26.	Engine, Chicago, Ill.	Apr. 15
Apr. 26.	Pipe, hydrants, etc., Hadley, Mass.	Apr. 15
Apr. 28.	System, Cassville, Mo.	Apr. 15
Apr. 29.	Pipe, etc., Waterville, Me. Adv. Apr. 15.	Apr. 15
May 1.	Shirley, Ind.	Feb. 11
May 1.	Laying pipe, etc., Brandon, Man., Adv. Apr. 15	Apr. 15
May 1.	Reservoir, Ft. Wright, Wash.	Apr. 15
May 1.	Water tower, Salem, Va.	Apr. 15
May 1.	Canal, etc., Cody, Wyo. Adv. Apr. 15.	Apr. 15
May 1.	Engine house, etc., Ford City, Pa.	Apr. 15
May 1.	Scotia, N. Y.	Apr. 15
May 2.	Pump'g plant, Downey, Cal.,	Apr. 8
May 2.	Well, etc., Panguitch, Utah,	Apr. 8
May 2.	Flow line, St. Louis, Mo.	Apr. 15
May 2.	Pipe laying, Cincinnati, O.	Apr. 8
May 3.	Lexington, N. C. Adv. Apr. 15.	Apr. 15
May 4.	Imp. plant, De Pere, Wis.	Apr. 15
May 5.	Pipe, etc., West Point, N. Y. Adv. Apr. 8, 15.	Apr. 8
May 6.	Tank, Ft. Reno, Okla. Ter.	Apr. 15
May 11.	Pipe, New Orleans, La.	Mar. 25
May 11.	Pipe, West Point, N. Y. Adv. Apr. 15	Apr. 15.
May 11.	System, Ft. Ontario, N. Y. Adv. Apr. 15.	Apr. 15
May 14.	System, Mansfield, La. Adv. Mar. 4, 11.	Mar. 4
May 15.	Engine, etc., Montreal, Que. Adv. Mar. 11.	Mar. 11
May 16.	Irrig. work, North Platte, Neb. Adv. Mar. 25 to Apr. 15.	Mar. 25
June 1.	Canal, etc., Glendive, Mont., Adv. Apr. 8, 15.	Apr. 8
Jun. —.	Prescott, Wash.	Apr. 1

SEWERAGE AND SEWAGE DISPOSAL.

Apr. 17.	Norristown, Pa.	Apr. 8
Apr. 17.	Jersey City, N. Y.	Apr. 15
Apr. 17.	Harrisburg, Pa.	Apr. 15
Apr. 17.	St. Paul, Minn.	Apr. 15
Apr. 18.	Davenport, Ia.	Apr. 15
Apr. 18.	New Orleans, La. Adv. Feb. 18 to Apr. 8.	Feb. 18
Apr. 18.	Findlay, O.,	Apr. 15
Apr. 19.	Winchester, Ind	Apr. 8
Apr. 19.	New York, N. Y.	Apr. 15
Apr. 19.	Amsterdam, N. Y.	Apr. 15
Apr. 20.	Wilton, N. H.	Apr. 8
Apr. 20.	Salem, Mass., Adv. Apr. 8.	Apr. 8
Apr. 20.	Coffeyville, Kan.	Apr. 15
Apr. 20.	Augusta, Ga.	Apr. 15
Apr. 24.	Muskogee, Ind. Ter.	Apr. 8
Apr. 24.	Lafayette, Ind.	Apr. 15
Apr. 26.	Ft. Caswell, N. C.	Apr. 15
Apr. 26.	Brooklyn, N. Y.	Apr. 15
May 1.	Lexington, Ky.	Apr. 1
May 1.	Toronto, O.	Apr. 15
May 2.	Panguitch, Utah	Apr. 8
May 2.	Waterbury, Conn.	Apr. 15
May 3.	Cincinnati, O.	Apr. 15
May 4.	Saltsburg, Pa.	Apr. 15
May 4.	Jacksonville, Fla.	Apr. 15
May 6.	Ft. Wayne, Ind.	Apr. 15
May —	New Britain, Conn.	Apr. 8
May 2.	Bloomfield, Ind.	Apr. 15
May 2.	Versailles, Ind.	Apr. 15
May 4.	Cincinnati, O.	Apr. 15
May 4.	St. Charles, Mo. Adv. Apr. 15.	Apr. 1
May 6.	Washington, Pa.	Apr. 15
May 9.	Atlantic City, N. J.	Apr. 15
May 10.	Ft. Greble, R. I. Adv Apr. 15.	Apr 15
———	Belair, Md.	Apr. 8

BRIDGES.

Apr. 12.	New York, N. Y.	Apr. 15
Apr. 18.	Pittsburg, Pa.	Apr. 15
Apr. 19.	Moscow, Idaho	Mar. 11
Apr. 19.	Cleveland, O.	Apr. 1
Apr. 19.	Birmingham, Ala.	Apr. 15
Apr. 19.	Syracuse, N. Y.	Apr. 15
Apr. 21.	Cincinnati, O.	Mar. 25
Apr. 21.	Tacoma, Wash.	Apr. 8
Apr. 25.	Cleveland Heights, O.	Apr. 1
Apr. 25.	Indianapolis, Ind.	Apr. 8
Apr. 26.	Denver, Colo. Adv. Apr. 1 to 15	Apr. 1
Apr. 29.	Cleveland, O.	Apr. 8
May 1.	Richland, Ark.	Mar. 11
May 1.	Washington, D. C. Adv. Apr. 8, 15.	Apr. 8
May 1.	Medina, O.	Apr. 15
May 1.	Greenwood, Ark.	Apr. 15
May 2.	Carrollton, Mo.	Apr. 15
May 3.	Peru, Ind.	Apr. 8
May 3.	Wabash, Ind.	Apr. 8
May 3.	Bluffton, Ind.	Apr. 15
May 4.	Wabash, Ind.	Apr. 15
May 4.	Columbus, O.	Apr. 15
May 4.	Birmingham, Ala.	Apr. 15
May 5.	Lockland, O.	Apr. 8

PAVING AND ROADMAKING.

Apr. 16.	Reading, Pa.	Apr. 8
Apr. 17.	Cincinnati, O.	Mar. 25
Apr. 17.	Jersey City, N. J.	Apr. 15
Apr. 17.	Rensselaer, Ind.	Apr. 1
Apr. 17.	Montgomery, Ala.	Apr. 1
Apr. 17.	Perrysburg, O.	Apr. 1
Apr. 17.	New York, N. Y.	Apr. 8
Apr. 17.	Greensboro, N. C. Adv. Apr. 8, 15.	Apr. 8
Apr. 17.	Norristown, Pa.	Apr. 8
Apr. 17.	Carrick, Pa.	Apr. 15
Apr. 17.	Cannonsburg, Pa.	Apr. 15
Apr. 17.	Lynn, Mass.	Apr. 15
Apr. 17.	Syracuse, N. Y.	Apr. 15
Apr. 17.	St. Paul, Minn.	Apr. 15
Apr. 18.	Mankato, Minn. Adv. Apr. 1, 8.	Apr. 1
Apr. 18.	La Crosse, Wis.	Feb. 25
Apr. 18.	Red Oak, Ia.	Apr. 8
Apr. 18.	Escanaba, Mich., Adv. Apr. 8.	Apr. 8
Apr. 18.	Pittsburg, Pa.	Apr. 15
Apr. 18.	Davenport, Ia.	Apr. 15
Apr. 18.	Lynn, Mass.	Apr. 15
Apr. 19.	Cincinnati, O.	Apr. 15
Apr. 20.	Gettysburg, Pa.	Apr. 1
Apr. 20.	New York, N. Y.	Apr. 15
Apr. 21.	Cincinnati, O.	Mar. 25
Apr. 21.	Traverse City, Mich. Adv. Apr. 8, 15.	Apr. 8
Apr. 21.	Attica, Ind.	Apr. 15
Apr. 22.	Williamsport, Ind.	Apr. 15
Apr. 22.	Washington, D. C. Adv. Apr. 15.	Apr. 15
Apr. 22.	Bluffton, Ind.	Apr. 15
Apr. 24.	Cincinnati, O.	Apr. 1
Apr. 24.	Bowling Green, O.	Apr. 8
Apr. 24.	Wellsboro, O.	Apr. 8
Apr. 24.	Pittsburg, Pa.	Apr. 8
Apr. 24.	Indianapolis, Ind.	Apr. 15
Apr. 24.	Mt. Vernon, Ind.	Apr. 15
Apr. 24.	Muncie, Ind.	Apr. 15
Apr. 24.	Clairton, Pa.	Apr. 15
Apr. 25.	St. Louis, Mo.	Apr. 15
Apr. 26.	Cincinnati, O.	Apr. 8
Apr. 26.	Hoboken, N. J.	Apr. 8
Apr. 26.	Brooklyn, N. Y.	Apr. 15
Apr. 26.	Paducah, Ky.	Apr. 15
Apr. 27.	Augusta, Ga., Adv. Apr. 15.	Apr. 15
Apr. 28.	Youngstown, O.	Apr. 15
Apr. 29.	Wilkesbarre, Pa. Adv. Apr. 15.	Apr. 15
Apr. 30.	Vicksburg, Miss.	Mar. 25
May 1.	Parkridge, Ill.	Mar. 11
May 1.	Evansville, Ind.	Apr. 1
May 1.	Ft. Porter, N. Y.	Apr. 15
May 1.	Bucyrus, O.	Apr. 15
May 1.	Bedford, Ind.	Apr. 15
May 1.	Vernon, Ind.	Apr. 15
May 1.	New Brunswick, N. J.	Apr. 15
May 2.	Trenton, N. J., Adv. Apr. 15.	Apr. 15

POWER, GAS AND ELECTRICITY.

Apr. 18.	Washington, D. C.	Apr. 8
Apr. 18.	New York, N. Y.	Apr. 15
Apr. 18.	Nashville, Tenn.	Apr. 15
Apr. 19.	Lake Charles, La.	Apr. 15
Apr. 20.	Lindsborg, Kan., Adv. Apr. 8,	Apr. 8
Apr. 20.	New York, N. Y.	Apr. 15
Apr. 20.	Barnesville, O.	Apr. 15
Apr. 24.	Janesville, Wis.	Apr. 1
Apr. 24.	Brooklyn, N. Y.	Apr. 15
Apr. 25.	Washington, D. C.	Apr. 1
Apr. 26.	Des Moines, Ia.	Apr. 15
Apr. 27.	Ligonier, Ind. Adv. Mar. 25 to Apr. 8.	Mar. 25
Apr. —.	Ft. Valley, Ga.	Jan. 21
May 1.	Empire, Colo.	Mar. 18
May 1.	Shirley, Ind.	Feb. 11
May 1.	Meridian, Miss.	Apr. 15
May 1.	Keene, N. H. Adv. Apr. 8, 15.	Apr. 8
May 2.	Modesto, Cal.	Mar. 25
May 2.	Ft. Ontario, N. Y. Adv. Apr. 8, 15.	Apr. 8
May 3.	Washington, D. C.	Apr. 8
May 3.	Ft. Brady, Mich., Adv. April 15	Apr. 15
May 10.	Lyons, Kan.	Apr. 8
May 15.	Jewell City, Kan.	Mar. 18
May —.	Meridian, Miss.	Mar. 25
Jun. 3.	Cape Charles, Va.	Apr. 8

BUILDINGS.

Apr. 17.	School, Harrison, N. J.	Apr. 1
Apr. 17.	Schools, Brooklyn, N. Y.	Apr. 8
Apr. 17.	School, New York, N. Y.	Apr. 8
Apr. 17.	School, Dorchester, Mass.	Apr. 15
Apr. 18.	Pub. Bldg., St. Joseph, Mo.	Mar. 18
Apr. 18.	Library, Cincinnati, O.	Mar. 25
Apr. 18.	Boro Hall, New Brighton, S. I., N. Y.	Apr. 8
Apr. 18.	R. C. Church, Delevan, Ill.	Apr. 15
Apr. 18.	Bus. Bldg., Houston, Tex.	Apr. 15
Apr. 18.	Pub. Bldg., Hamilton, O.	Apr. 15
Apr. 19.	Boilers in Reform, Mansfield, O.	Apr. 1
Apr. 19.	Htg. Pub. Bldg., Ft. Slocum, N. Y.	Apr. 8
Apr. 19.	Boilers in Reform'y, Mansfield, O.	Apr. 1
Apr. 19.	Court House, New York, N. Y.	Apr. 15
Apr. 19.	Pub. Bldgs., Sedalia, Mo.	Apr. 15
Apr. 20.	Officers' quarters, etc., West Point, N. Y. Adv. Mar. 25 to Apr. 15.	Mar. 25
Apr. 20.	Pub. Bldg., Ft. Strong, Mass,	Apr. 8
Apr. 20.	Court House, Norman, Okla. Ter.	Apr. 8
Apr. 20.	Pub. Bldgs., Ft. Columbia, Wash.	Apr. 15
Apr. 20.	School, Paulding, O.	Apr. 15
Apr. 20.	Pub. Bldg., Cincinnati, O.	Apr. 15
Apr. 20.	City Hall, Gainesville, Tex.	Apr. 15
Apr. 20.	Brewery, Kittanning, Pa.	Apr. 15
Apr. 20.	Court House, Madison, Ga.	Apr. 15
Apr. 21.	Pub. Bldg., Biddeford Pool, Me.	Apr. 15
Apr. 21.	Pub. Bldg., Red Bank, N. J.	Apr. 15
Apr. 21.	School, Lawrence, Kan.	Apr. 15
Apr. 21.	School rprs., Newark, N. J.	Apr. 15
Apr. 22.	Storehouse, Ft. Missoula, Mont.	Apr. 1
Apr. 22.	Pub. Bldg., Charleston, S. C.	Apr. 1
Apr. 22.	School, Dexter, Ia.	Apr. 8
Apr. 22.	Htg. P. O., Nanaimo, B. C.	Apr. 15
Apr. 22.	School, West Liberty, Pa.	Apr. 15
Apr. 24.	School, New York, N. Y.	Apr. 1
Apr. 24.	Infirmary, Steubenville, O.	Apr. 1
Apr. 24.	Pub. Bldgs., Ft. Andrews, Peddocks Island, Mass.	Apr. 1
Apr. 24.	Htg. P. O. Bldg., Charlottesville, Va., Adv. Apr. 1, 8.	Apr. 1
Apr. 24.	Court House, St. Joseph, La.	Apr. 8
Apr. 24.	College, New York, N. Y.	Apr. 15
Apr. 24.	Bus. Bldg., Columbus, Ind.	Apr. 15
Apr. 24.	Bus. Bldg., Anderson, Tex.	Apr. 15
Apr. 24.	School, Columbus, O.	Apr. 15
Apr. 24.	Plumb. College, New York, N. Y.	Apr. 15
Apr. 24.	Improv. engine houses, Brooklyn, N. Y.	Apr. 15
Apr. 24.	Schools, New York, N. Y.,	Apr 15
Apr. 24.	Schools, Brooklyn, N. Y.,	Apr. 15
Apr. 25.	Htg. P. O. Bldg., Pierre, S.D.	Apr. 1
Apr. 25.	Post Bldgs., Ft McPherson, Ga., Adv. Apr. 1 to 15	Apr. 1
Apr. 25.	School, Aberdeen, S. D.	Apr. 8
Apr. 25.	Univ. Ann Arbor, Mich.	Apr. 15
Apr. 25.	Office Bldg., Baltimore, Md.	Apr. 15
Apr. 25.	Schools, Van Wert, O.	Apr. 15
Apr. 25.	Academy improv., Pocatello, Idaho	Apr. 15
Apr. 25.	Pub. Bldg., Lead, S. D.	Apr. 15
Apr. 25.	School, Indianapolis, Ind.	Apr. 15
Apr. 26.	School, McMechen, W. Va.	Apr. 1
Apr. 26.	Library, Bangor, Me.	Apr. 15
Apr. 27.	P. O. Bldg., Flint, Mich.	Apr. 8
Apr. 27.	Pub. Bldgs., Lima, O.	Apr. 8
Apr. 27.	Court House, Magnolia, Ark.	Apr. 15
Apr. 28.	Post Bldgs., Ft. Moultrie, Ga., Adv. Apr. 1 to 15	Apr. 1
Apr. 28.	Court House, Wynne, Ark.	Apr. 1
Apr. 28.	School, Cresco, Ia.	Apr. 15
Apr. 29.	Htg. Pub. Bldg., Washington Barracks, D. C. Adv. Apr. 1 to 15.	Apr. 1
Apr. 29.	Pub. Bldgs., Boston, Mass.	Apr. 8
Apr. 29.	Church, Steubenville, O.	Apr. 15
Apr. 29.	School, Webster, S. D.	Apr. 15
Apr. 30.	Bank, Buffalo, N. Y.	Apr. 1
Apr. —.	Hospital, Oakland, Cal.	Apr. 15
Apr. —.	School, New Haven, Conn.	Mar. 4
Apr. —.	Asylum, Jamestown, N. D.	Mar. 25
May 1.	College plans, Washington, D. C.	Mar. 25
May 1.	Remov. Pub. Bldgs., Sulphur, Ind. Ter.	Apr. 1
May 1.	P. O. Bldg., Jacksonvil Adv. Apr. 1, 8.	
May 1.	School, Sharpsville, I	
May 1.	Pub. bldg. plans, Jef City, Mo., Adv. Apr. 8	
May 1.	Schools, New York, N	
May 2.	School, Panquitch, Utal	
May 2.	Hospital, St. Louis, M	
May 2.	Court House, Detroit,	
May 2.	School, Madison, Wis	
May 3.	Court House, Vinton, I	
May 4.	Boat House, Ft. Morga Adv. Apr. 15.	
May 6.	P. O. Bldg., Florence,	
May 8.	Interior finish, U. S. C House, New York, N Adv. Mar. 11, 18	
May 9.	Mech. Equip. U. S. C House, New York, N Adv. Mar. 11, 18	
May 11.	P. O. Bldg., Laramie,	
May 11.	Hospital Improv., Ft. niboine, Mont.	
May 12.	Post Bldgs., Prescott,	
May 15.	School, Port Arthur, T Adv. Apr. 15.	
May 15.	Post Bldgs., Ft. Sam ton, Tex., Adv. Apr.	
May 16.	Pub. Bldg., Elkhart, In	
May 22.	P. O. Bldg., Oil City, Adv. Apr. 15.	
Jun. 15.	Court House plans, Ne leans, La.	
Jun. 15.	Synagogue plans, Ho Tex.	
Jun. 20.	School, Dillon, Mont.	
———.	Jail, etc., Beaufort, N.	

MISCELLANEOUS.

Apr. 17.	Dam No. 2, Pittsburg, Adv. Mar. 18 to Apr. 8	
Apr. 17.	Dam No. 3, Pittsburg, Adv. Mar. 18 to Apr. 8	
Apr. 17.	Dredging Coney Island, Harbor, Adv. Apr. 1, 8	
Apr. 17.	Boardwalk, Atlantic N. J. Adv. April 1.	
Apr. 17.	Piers, New York, N. Y	
Apr. 17.	Sprinkling, Syracuse, N.	
Apr. 17.	Cement, etc., Cambr Mass.	
Apr. 18.	Dredging, New York, N	
Apr. 18.	R. R. Tunnel, New N. Y., Adv. 1 to 15	
Apr. 18.	Dam No. 5, Pittsburg, Adv. Mar. 25 to Apr. 1	
Apr. 18.	Levee work, Point Hache, La.	
Apr. 18.	Supplies, Wash., D. C.	
Apr. 18.	Pier, Edgewater, N. J. Adv. Apr. 8, 15.	
Apr. 18.	Dredging, Ellis Island, Harbor	
Apr. 19.	Dam No. 4, Pittsburg, Adv. Mar. 25 to Apr.	
Apr. 19.	Dam, San Francisco, Ca Adv. Mar. 25 to Apr.	
Apr. 19.	Supplies, Panama	
Apr. 19.	Dredging, Brooklyn, N.	
Apr. 19.	Cement, Chicago, Ill.	
Apr. 20.	Broken stone, etc., York, N. Y.	
Apr. 20.	St. cleaning, Rome, N.	
Apr. 21.	Bulkhead, Lorain, O.	
Apr. 21.	Drainage, Havana, Ill.	
Apr. 22.	Dredging, Pittsburg, Pa.	
Apr. 24.	Garb. Crematory, Los A les, Cal.	
Apr. 24.	Broken stone, etc., York, N. Y.	
Apr. 25.	Dredging, New Orleans,	
Apr. 25.	Ditch, Windom, Minn.	
Apr. 25.	Pipe covering, Dayton, C	
Apr. 25.	Watering trucks, Brook N. Y.	
Apr. 27.	Trap Rock, Holyoke, Ma	
Apr. 28.	Garb. Disp., Washing D. C.	
Apr. 28.	St. cleaning, Akron, O.	
Apr. 29.	Coal handling plant, New leans, La.	
Apr. 29.	Dock, Burlington, Vt.	
May 1.	R. R. work, Toronto, Ont	
May 1.	Machinery, Panama, A Apr. 1 to 15	
May 1.	Cement, etc., Portland, Adv. Apr. 15.	
May 2.	Tools, etc., Panama Adv. Apr. 1 to 15.	
May 2.	Drainage work, Brec ridge, Minn.	
May 3.	Steam shovels, Panama Adv. Apr. 1 to 15.	
May 3.	Dredging, Newport, R. I. Adv. Apr. 1 to 15.	
May 3.	Dam, Parkersburg, W. V Adv. Apr. 8, 15.	
May 3.	Jetty construction, N tucket, Mass. Adv. Apr. 8, 15.	
May 4.	Garb. Disp., Philadelphia,	
May 6.	Quay Wall, Bremerton, W	
May 6.	Breakwater work, Cleve land, O.	
May 6.	Cableways, Guantana Cuba	
May 8.	Dredging, Newport, R. I. Adv. Apr. 15.	
May 10.	Ditch, Stevens Point, Wis	
May 10.	Elevator, New York, N.	
May 10.	Earth spreaders, etc., Pana Adv. Apr. 15.	
May 12.	Removing rock, New Yo N. Y., Adv. Apr. 15	
May 12.	Supplies, Panama (2 prop Adv. Apr. 15.	
May 13.	Supplies, Panama (2 prop Adv. Apr. 15.	
May 13.	Pier improv., Buffalo, N. Adv. Apr. 15.	
May 15.	Dredging, Providence, R. I	
May 15.	Sanitary fixtures, etc., Pa ama (2 prop.) Adv. Apr. 15.	
May 16.	Supplies, Washington, D.	
Jul. 1.	Municipal St. Ry. syste Chicago, Ill., Adv. Apr.	
Sept. 1.	Steel and iron, Sydney, Adv. Apr. 8. S. W.	
————	R. R. Work, Corry, Pa.	

*Items marked thus give the names of parties awarded contracts.